Proceedings of the
American Association of Textile Chemists and Colorists

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Editor of Proceedings: Carl Z Draves, 30 Lahey St, New Hyde Park, N Y

DECEMBER 21, 1953

Bonnar Re-Elected President for '54

CENTRAL ATLANTIC, WESTERN REGIONS ELECT NEW VP's

J ROBERT BONNAR
President
(General Dyestuff Corp)

GEORGE L BAXTER
Vice President
(Bradford Dyeing Assoc)

SAMUEL L HAYES
Vice President
(Ciba Company, Inc)

JOSEPH H JONES
Vice President
(Phoenix Dye Works)

GEORGE O LINBERG
Vice President
(Synthron, Inc)

J ROBERT BONNAR, General Dyestuff Corporation, has been re-elected to the presidency of the American Association of Textile Chemists and Colorists for 1954, official tabulations reveal.

In a close contest in the Central Atlantic Region, George L Baxter, Bradford Dyeing Association, won over Arthur W Etchells, Hellwig Dyeing Corp, in the contest for vice president. Mr Baxter polled 595 votes, while the incumbent, Mr Etchells, received 508.

In the Western Region, Joseph H Jones, Phoenix Dye Works, was elected to the vice presidency, succeeding Arthur T Brainerd, Ciba Co, Inc.

Samuel L Hayes, Ciba Co, Inc, and George O Linberg, Synthron, Inc, were re-elected vice presidents in the Southern and New England Regions, respectively.

EMPLOYMENT REGISTER

This column is open for two insertions per year, per member, without charge. Blanks can be obtained from, and filed with, the Secretary of the Association, Lowell Textile Institute, Lowell, Mass. It is understood that these will be open to inspection by prospective employers who can obtain further information from the Secretary.

53-33

Education: textile chemistry and dyeing, college degree.

Experience: textile chemist and colorist, laboratory.

Age: 39; married; references; position as colorist and chemist in sales service laboratory desired; New England or New York preferred but not essential.

12-7, 12-21

CALENDAR

COUNCIL
1954—Jan 22, Apr 30, June 15, Sept 15, Nov 19.
1955—Jan 21, Apr 15, June 17

NATIONAL CONVENTIONS
Sept 15-18, 1954 (Atlanta Biltmore, Atlanta, Ga); Sept 21-23, 1955 (Chalfonte-Haddon Hall, Atlantic City, N J).

HUDSON-MOHAWK SECTION
Jan 22 (Albany); March 5; April 9, May 14 (Albany); June 18 (Outing).

MID-WEST SECTION
February 13 (Hotel Bismarck, Chicago, Ill).

NEW YORK SECTION
Jan 29, Feb 26 (Hotel Statler, N Y); April 23, May 21 (Swiss Chalet).

PACIFIC SOUTHWEST SECTION
Jan 29.

PIEDMONT SECTION
Jan 30 (Hotel Poinsette, Greenville, S C); Apr 10 (Hotel Roanoke, Roanoke, Va); June 11-12 (Outing, Mayview Manor, Blowing Rock, N C); Sept 11 (Hotel Barringer, Charlotte, N C).

PHILADELPHIA SECTION
Jan 15.

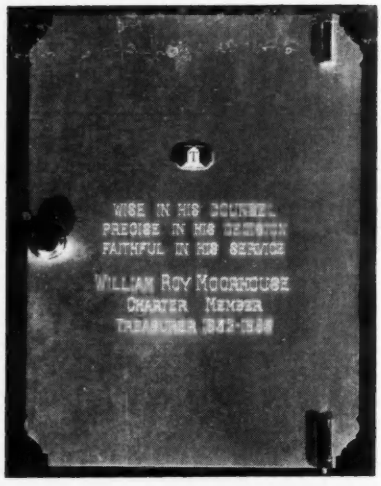
NOTICE TO SECRETARIES AND PUBLICITY CHAIRMEN OF LOCAL SECTIONS

Papers presented before local sections should be sent to Dr Carl Z Draves Editor of the *Proceedings*, 30 Lahey Street, New Hyde Park, New York. Authors should provide two copies for this purpose.

Reports of local section meetings should be sent to the American Dyestuff Reporter with copies going to Dr H C Chapin, National Secretary.

Dates of meetings and advance notices of meetings should be sent to the American Dyestuff Reporter with copies also going to Dr Chapin. For publication in any particular issue, information should be in the office of the Reporter 17 days before the issuance date.

W R MOORHOUSE HONORED WITH GIFT FROM ASSOCIATION OFFICIALS



(Left): Front view of the English "Bird Cage" clock presented to W R Moorhouse. (Right): Inscribed on the door: "Wise in his counsel, precise in his decision, faithful in his service—William Roy Moorhouse, Charter Member, Treasurer 1932-1953."

IN appreciation of his 21 years of service as treasurer, AATCC officials on Thanksgiving Day presented to W R Moorhouse, treasurer emeritus, an English "bird cage" clock. In conjunction with the presentation, the following letter, signed by Albert E Sampson, treasurer, was given to Mr Moorhouse:

November 25, 1953

Dear Mr Moorhouse,

On Thanksgiving Day we give Thanks for the many blessings we have enjoyed throughout the year and re-dedicate ourselves to uphold the Heritage of our Founding Fathers. Not least among these blessings for which we as an Association give thanks this day are the many years William R Moorhouse has served us as Treasurer and through whose good offices the Association has grown and prospered.

The Officers and Council in appreciation of your Talents and Faithful Service give tangible evidence of their gratitude in their presentation to you of a timepiece which as it strikes the hours through the many years ahead may be a constant reminder to you of their esteem and affection.

May our thoughts of you add to the graciousness of the day and by its magnificence make it a happier one for you and yours.

Mr Moorhouse replied to Mr Sampson in part as follows:

"It was very thoughtful of the Council and Officers of AATCC to remember me in this manner. Please convey to them my sincere appreciation. Every time I look at this handsome gift it brings me pleasant memories of the many enjoyable as well as profitable hours spent with the officers, council, research committees and other members of the Association."

Inscribed inside the clock door is the following:

By reason of these virtues, we, the national officers, Council, and committee chairmen, have on September 17, 1953, unanimously elected him,

— "Treasurer Emeritus" —

That his example may long endure among us.

National Officers:

J Robert Bonnar—President

A T Brainerd, A W Etchells, S L Hayes, G O Linberg — Vice Presidents

Harold C Chapin—Secretary
Albert E Sampson—Treasurer
Leonard S Little—Chairman, ECR
Harold W Stiegler—Director of Research

Councilors:

C T Anderson	J J Hanlon	A D Nute
W D Appel	W G Helmus	F J O'Neil
G S Barker	A E Herrmann, Jr	C N Rabold
E B Bell	H F Herrmann	A E Raimo
G R Bellamy	A I Hultberg	E E Rettberg, Jr
C H Brubaker	R W Jacoby	L O Reynolds
W H Cady	P J Kennedy	R E Rupp
R J Carey	E H Killheffer	W M Scott
E C Diehl	S Klein	H G Smith
C W Dorn	T Larson	T R Smith
C Z Draves	E W Lawrence	R H Souther
A Eavenson	J Lindsay, Jr	R B Stehle
E E Fickett	J J Marshall	S F Sylvester
R M Fischer	R Mishoe	S G Turnbull, Jr
C R Gill	E Morrill	P J Wood
		H L Young

Committee Chairmen:

K H Barnard	G L Baxter	E W Camp
W A Holst, Jr	G D Jackson, Jr	G H Schuler
	P Theel	

Western New England Section——

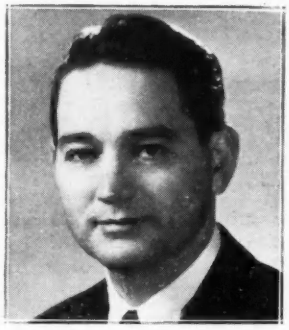
CHEMISTRY OF CHELATION IN TEXTILE PROCESSING*

A J GARD

Bersworth Chemical Co, Framingham, Mass

INTRODUCTION

THE subject of chelation is drawing special attention from both analytical and industrial engineers simply because the industrial applications have moved ahead with such striking effects that some reflection is always in order when a new approach takes hold as firmly as chelation. Most recent unique industrial applications are those in cold rubber production and, in agriculture, the correction of iron chlorosis in citrus trees of Florida. Industrial engineers approached on Versene always ask, "What is this chelation business and this word chelate?" "Where did the word come from, what does it mean and what about sequestering action?" The word "chelate" was first coined by Morgan back in 1920 to designate a ring structure formed by an organic or inorganic complexing agent and a metal ion. The word itself is derived from the Greek word "Kelos", referring to the great claw of the lobster, and it is applied to the ring structure because of the caliper-like character of the metal-organic molecule. The difference between complexing, sequestration, and chelation is essentially a matter of chemical structure. A complexing agent is any agent which will inactivate a metallic ion. The most common complexing agents are ammonia, cyanide, citrates and tartrates. All sequestering and chelating agents are complexing agents. Sequestration is the ability to form soluble metal complexes. Ammonia, cyanide, hexametaphosphate, Versene, and other condensed phosphates are examples of sequestering agents. A chelating agent is any compound which will inactivate a metallic ion by enclosing it in an inner-ring structure.



A J Gard

Recent industrial developments employing chelation reactions are now firmly established.

The advent of chelation with EDTA sodium salts has brought some reasonable order to the use of complexing agents in textile processing. The rates of reaction, stability and versatility of EDTA are proving its economy against condensed phosphates. However, the use of EDTA in combination with certain phosphates gives better money value because of synergism.

A new dyeing technique employing the restraining action of chelating agents to promote the leveling of mordants has not yet been fully explored. The effect of chelation on redox potentials is another interesting development.

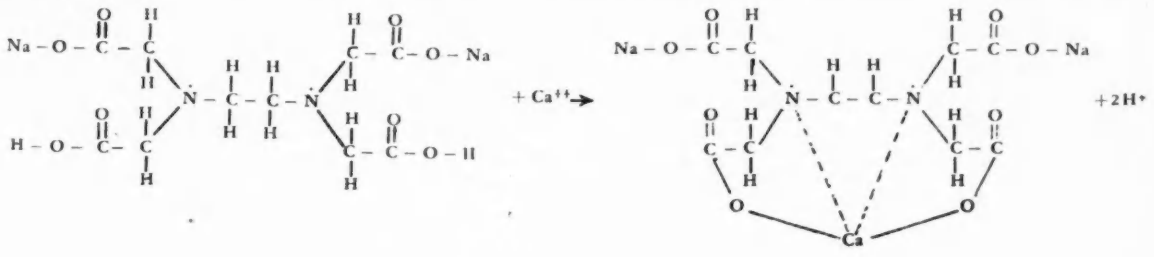
A discussion of the applications of EDTA in continuous bleaching, dyeing and soaping off processes are included.

HISTORICAL —— Bersworth first prepared the Versene acid back in 1929 working at Clark University. This material was made available commercially on a limited scale in the mid-thirties by Bersworth Laboratories under the name of "FRP-26". The Bersworth process was patented, and a different method of synthesis was devised and patented by the I G Farben Industries. The German product was called Trilon B; the American products are called Versene, Nullapon and Sequestrene. These compounds are classed as polyamino carboxylic acids and henceforth are referred to in this paper as EDTA for ethylenediaminetetra-acetate.

CHEMISTRY

Actually, chelation is analogous to the titration of an acid by a base; the metal ion is considered an acid and the chelating agent a base. The chelating agent acts as a donor of electrons and the metal ion, as the acceptor of electrons. In the process of chelation the metal ion is neutralized by the chelating agent. Generally speaking, the higher the valence of the metal ion the greater the tendency for chelation to take place. Trivalent metal ions, such as ferric and chromic, would then be chelated before divalent-metal ions and this is actually the case. Being analogous to the acid-base neutralization reaction, you then have a definite measurable chemical reaction based on stoichiometric quantities of reactants. For this reason the analytical chemist is now employing EDTA since it forms exceedingly stable complexes with a large number of metal ions.

Most of us wish to by-pass the general chemistry of electrons and atomic size, but we put it to good use in chelation. To explain the stability of the chelates of EDTA we must examine the structure of the molecule, which is a symmetrical arrangement of hydrogen, carbon, nitrogen and oxygen atoms. (See structural formula at bottom of page.) A common example is the combination with divalent calcium ion as in softening of hard water. In the course of chelation by the sodium salt of EDTA the calcium ion is immediately tied up through two of the terminal carboxyl



* Presented before the Western New England Section at Rapp's Restaurant in Shelton, Conn, on March 20, 1953.

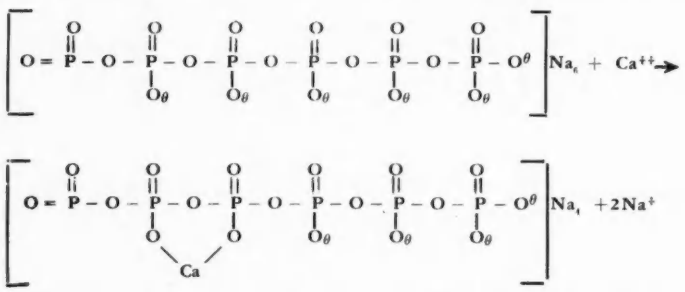
groups, and then the unshared electrons of the nitrogen atoms are shared by the calcium ion giving the whole structure great stability. As we pointed out, trivalent metal ions are chelated more strongly than divalent metal ions. Thus, the order of chelation would be Fe^{III}, Cr^{II}, Cu, Ni, Zn, Pb, Fe^{II}, Mn and then the alkaline earth metal ions Ca, Mg, Sr, and Ba. This order can be altered by changing the pH and/or precipitating anions. Generally speaking, all metal chelates become less stable and dissociate more as the pH is lowered. The most effective range for iron and chromium is in the acid pH range from 3.0 through 7.0. However, the chelate compounds of divalent metals become increasingly stable as the pH is increased. The divalent metals are complexed more strongly in the alkaline pH range and even in highly caustic solutions.

CALCIUM REPRESSION NUMBER ——To compare chelation by EDTA with sequestering action by dehydrated or glassy phosphates the common denominator is the calcium repression number. This number represents the parts of any given complexing agent required to complex one part of calcium carbonate. In our work the oxalate ion is the precipitating agent. As stoichiometric calculations are used with EDTA this means one mole of tetrasodium EDTA will chelate one mole of calcium ion. On a mole weight basis if anhydrous tetrasodium EDTA (mole weight 380) and calcium carbonate ($CaCo_3$, mole weight 100) are used, we have a calcium repression number of 3.80:1. This is represented in Figure 1. As no mole-to-mole ratio exists for phosphates, stoichiometric relationships cannot be used for the calculation of calcium repression for phosphates.

The curves represented in Figure 1 against soap as the precipitating anion show the efficiency of dehydrated phosphates over a given pH range. The calcium repression number can be determined at any pH by taking the grams of phosphate/100 liters with conversion to milligrams of phosphate/liter and dividing by 17.9. The curves also significantly show why more phosphate is required to soften the same volume of water in the presence of soda ash. This would apply to any alkaline scouring or wet-finishing operation.

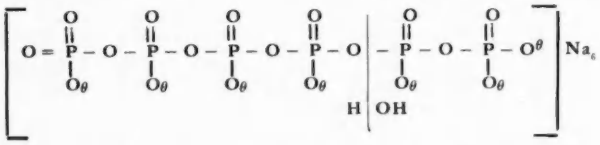
Increasing temperature, pH, and calcium content adversely affect calcium repression on one hand and accelerate reversion to orthophosphate on the other. This is true of all dehydrated or glassy phosphates, but the intensity of each variable changes with the ratio of Na_2O; P_2O_5 All the variables mentioned are without effect on the stability and efficiency of the sodium salt of EDTA.

A glance at the new thinking about the sequestering action of phosphate is that the divalent metal ion is tied up as a "chelate". A structural configuration *(2)* showing the condensation of the monomer $(Na\ PO_3)_x$ is as follows:



This, strictly speaking, is a double-salt formation, and. if this mode of sequestering by glassy phosphates occurs, then it can be classed as a chelate.

The rehydration or reversion of the condensed glassy phosphates *(3)* is conveniently expressed as follows:



Rates of reversion are greater for those glasses having Na_2O:P_2O_5 ratios approaching unity, being naturally much lower for sodium tripoly- and tetrapyrophosphates, but the condition must always be specified in any evaluation. The fact remains that so many variables enter into reversion or useful life that it is impossible to satisfy all the conditions. The obvious recourse is to use an excess of the glassy phosphate, but this does not predicate performance. Because EDTA is stable under all textile processing conditions, it removes all doubtful factors, and performance with economy has established organic chelating agents in practically all wet-finishing and dyeing operations.

A notable effect of a combination of Versene and TSPP (tetrasodium pyrophosphate) is a synergistic action on the sequestering power of TSPP. When a ratio of 2.0 or 2.5:1 of TSPP: Versene* is used, the amount of calcium tied up is greater than the combined calcium repression values of each. If 0.62g TSPP is dissolved in distilled water containing 0.25 g Versene powder and boiled briefly and then cooled, the titration against oxalate ion shows 73 to 75 mg $CaCl_2$ chelated, whereas 0.25 g Versene powder would account for 50 mg $CaCl_2$, and 0.62g TSPP would normally complex only 10 mg $CaCl_2$. A 20% boost is therefore realized. Also, through the efficient removal by Versene of the calcium ion, it eliminates the possible formation of insoluble double salts of calcium and/or magnesium pyrophosphate.

Other organic sequestering agents are making their appearance, such as gluconic acid, which you will hear more about. Through the usual pH range of 7 to 12 its sodium salt has a calcium repression value of 100, that is, 100 parts tie up one part of calcium. In more alkaline solutions, such as 5 to 9% sodium hydroxide, its repression value improves to 3:1 at room temperature. Since temperature adversely affects the repression value of such caustic solutions, that is, at high temperatures it increases to approximately 40:1, gluconates are not very effective at the elevated temperatures representative of most textile wet-finishing operations. Another factor to consider is their oxidation in alkaline solutions. Gluconic acid is a simple sugar in which a terminal CH_2OH group has been replaced by a carboxyl group. A paper has been published by the National Bureau of Standards showing the oxidation of gluconates in alkaline solution by atmospheric oxygen. This research paper, RP-1680, November, 1945, "Oxidation of Galacturonic and S-Keto-Gluconic Acid in Alkaline Solutions", can be obtained from the U S Printing Office.

USES OF CHELATING AGENTS

Rates of reaction are very important in the employment of chelating agents. A good example of a rapid reaction is the water-hardness test procedure employing disodium EDTA against a selective dye, Erio Chrome Black T. However, in any aqueous phase where a solid and one or

* Trade-marked name of Bersworth Chemical Company, which also holds U S Patent 2,387,735 for method of manufacture.

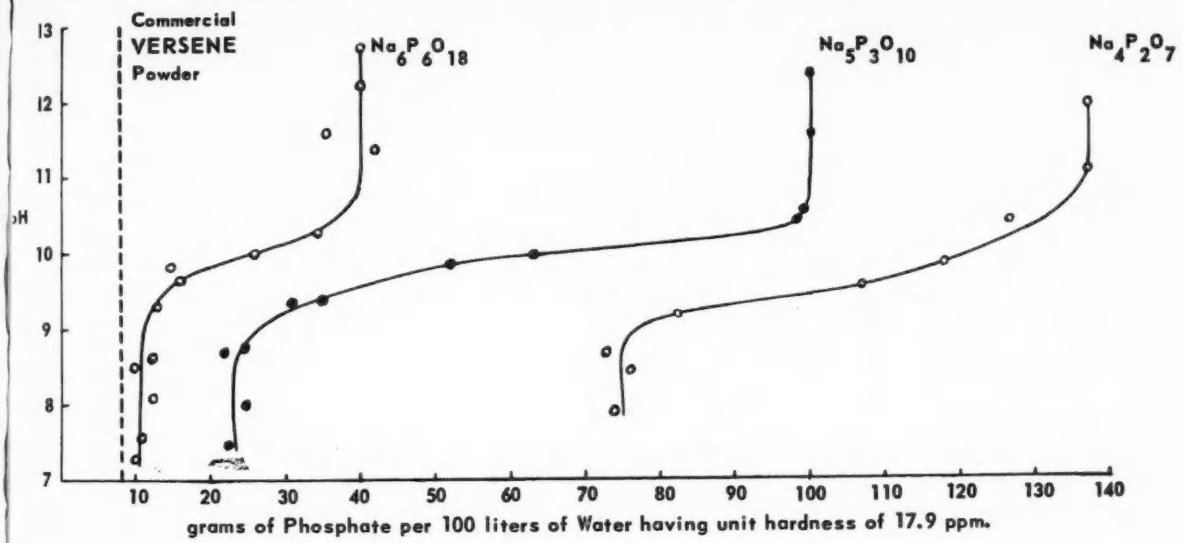


Figure 1

Softening Action EDTA vs Phosphates at Room Temperature
(From Rudy, Schloesser and Watzel (*1*) with Versene insert (*Tech Bull* No 2, Bersworth Chemical Co)

more complexing agents compete for heavy-metal ions, the response to chelation depends on the solubility product of the solid phase and the stability constants of the complexing agents. Consider then any wet-finishing or dyeing process involving fibers as solids and soaps and dyestuffs as complexing agents for heavy-metal ions.

It is well known that the cation-binding properties of cellulose, wool and certain synthetics increase with increasing temperature, and this also holds true for certain functional groups of dyestuffs. The nitroso, nitro, carboxyl, azoic, hydroxy and amino groups are the principal functional groups, and their relative positions in the structure of fibers and dyestuffs offer competition to complexing agents. Fibers and certain dyestuffs can pick up heavy-metal ions from water, trivalent metal ions binding first, followed by ions of divalent metals. The pH and temperature are variables that help break or strengthen the bonds similar to the effects on chelates of EDTA. If sufficient chelating agent is employed, the desired reaction will take place. This approach is discussed and graphically represented in "Organic Complexing Agents in Textile Processing" by J J Singer and F C Bersworth *(4)*.

IN DYEING——— A good example where careful selection of chelating action is necessary is with metalized colors. The chrome ion can readily be chelated away from the chromophoric group, and the chrome chelate of Versene is pink at low pH and progressively deeper with increasing pH. At 7 it is a deep purple. If ions of ferric ion are present in the water, the amount should be known and then an exact quantity of Versene powder added on a mole-for-mole basis. As the ferric-iron chelate of Versene is of higher order of stability than the chrome chelate, no interference with the metalized color will occur. Another approach is to use Fe-3 Specific, which cannot chelate the chrome ion from the dye but can remove heavy-metal ions. Also, a chrome chelate of Versene can be prepared and added to the dyebath to effect preferential chelation. An excess would do no harm to the metalized dyestuff, but the color effect of the Versene chrome chelate should be known before proceeding with the dyeing.

Another example of preferential chelation is in the chrome dyeing of wool. The presence of ferric ion in the dyebath is removed by Versene regardless of the concentration of chrome ion. It has also proved effective in the removal of copper ion.

Naphthols, vats and sulfur colors are made chemically reactive by solution with caustic soda and caustic soda plus a reducing agent, respectively. This means that the chemically reactive forms of these dyestuffs will readily combine with heavy-metal ions and with the calcium hardness of water used in their solution. It has been shown that the fastness to crocking of naphthols depends to a large extent on the complete solution of the naphtholate. No heavy-metal naphtholates form in the presence of Versene because the alkali and temperatures used in dyeing are without action on metals tied up by Versene. In soaping naphthols, TSPP, Versene, and soap are the best combination for developing the shade and increasing crock fastness.

Since all vats reduced to their leuco acids react with heavy-metal ions, the use of Versene in the padding liquor or alkaline reducing bath results in better color yield. Because the soaping-off of vat dyeings is mostly carried out with soda ash, TSPP and soap or synthetic detergent, there is justification now in the use of Versene in the formula to improve the crock and wash fastness more effectively while developing the shade.

Sulfur colors are capable of developing sulfuric acid by auto-oxidation, which is catalyzed by iron and copper salts, both of which can be removed with Versene. Bronzing is another major defect with sulfurs, but this is counteracted by the addition of 0.3% Versene T ows (on weight of solution). It can also be cleared by treating the cloth on a jig at 140°F with a bath containing 0.2% Versene T and 3% sodium sulfide, both ows. As Versene T prevents the formation of heavy-metal sulfides in alkaline solution, a padding bath containing Versene remains free of insoluble sulfides.

Another class of colors assumed to be little affected by small amounts of iron and copper are certain level-dyeing acid colors. Yet the anthraquinone acid dyestuffs are known to undergo conversion of the amino functional groups to hydroxy groups, and iron causes and catalyzes this conversion. The shade change can be prevented completely by the use of Versene *(5)*. The dulling effect of iron and copper

on other acid colors can be eliminated by chelation.

With direct cotton colors Versene generally prevents the shade change caused by heavy metals and also increases color yield. Generally, it can be stated that many direct colors have their light fastness considerably enhanced by the addition of copper salts. Versene would tend to decrease light fastness by chelating copper ions. However, as iron tends to decrease light fastness, in such cases Fe-3 Specific would be desirable to use.

The copper method employed for acrylonitrile fibers is an example where Versene could be employed to control the reservoir of cupric iron. The redox-potential effect has not been studied, but it is known that the cuprous ion is not chelated by EDTA. We are evaluating the use of Versene in the copper bath, and any significant benefit will be made available in a report.

BLEACHING ——— The continuous bleach range is an ideal place for chelating agents. First, iron, copper and calcium bound to the raw cotton or the greige goods should be removed in the caustic saturator. If the iron is present in the water even in the low amount of 0.1 ppm, and there is always some iron bound to the cotton, Versene T is the proper chelating agent to use for iron in caustic solutions of more than 1% caustic content. At 0.1%, Versene T will tie up 46 ppm of ferric ion and also 4 gr/gal of hardness. Any hardness greater than 4 gr/gal should be taken care of with regular Versene. As regular Versene does not chelate ferric iron efficiently in alkaline solutions, recourse is had to Versene T in caustic solutions of concentrations of 1% or greater. High temperatures in caustic solutions accelerate the chelation of iron mordanted to the cotton. The removal of surface metals at this stage of the continuous bleach assures a better white on bleaching with hydrogen peroxide.

The peroxide-saturator cycle has been the subject of much discussion with respect to silica control and peroxide performance. Our first approach is from the control of redox potential. Indications are that the presence of 0.01 to 0.05% of Versene ows in the saturator box has a stabilizing effect on potential readings, but the problem is to find a suitable reference electrode that does not decompose the peroxide. This might be a part of the answer to the better white obtained with Versene whether or not a plant has trouble with silicate scale problems. There are many types of amino and hydroxy carboxylic chelating agents suggested for tying up iron and copper in peroxide bleaching. Certain chelating agents actually accelerate the decomposition of peroxide solution even when it is stabilized with silicate. What happens is that, in the course of chelation, the iron is activated or sensitized and becomes a more powerful catalyst. We have shown this to be the case with our Fe-3 Specific in peroxide baths stabilized with silicate. Versene Fe-3 or Fe-3 Specific should not be added to a peroxide bath. Regular Versene has a definite stabilizing action as plant use has demonstrated. Peroxide manufacturers have likewise reported favorably on EDTA structure. Proof in practice is residual peroxide on goods from the J box and the better white. The best example of this is the elimination of silica deposition in peroxide J box equipment.

When silicate-scale problems are a common recurrence necessitating maintenance on week-end shutdowns, it has been our experience that, by gradual reduction of silica content and close control of Versene concentrations, silicate deposition is eliminated completely. Silicate ion competes or restrains chelation of the calcium by Versene, and thus, by controlling the ratio of silica to Versene with respect to hardness content of cloth and water, a proper balance can be worked out that is easily controlled and that produces better whites with elimination of scale, which causes rub marks on dyed pieces. Likewise, plants employing cold water for rinsing find silicates difficult to remove, and this is reflected in resistance to dye penetration on any continuous dyeing range. Lowering the silicate concentration with Versene added for bath stabilization eliminates the problem.

The discussion on the bleaching of cotton applies to the bleaching or raw wool and woolen piece goods. If scoured raw wool is bleached as a regular procedure, the intermittent addition of Versene powder to the peroxide bowl produces better whites in every plant adopting its use. The same is true of piece-goods bleaching in the presence of TSPP and ammonia when Versene is added to the bath at a concentration of 0.05 to 0.1% ows.

A typical case history is that of a mill scouring wool for felt hats, which encountered calcium-sulfate scale in the carbonizing section. The addition of Versene to the last soap bowl before rinsing to regenerate precipitated lime soaps eliminated the calcium-sulfate scale and likewise showed benefits in dyeing. Better levelness and brighter shades resulted. The dusting of browns and blues was completely eliminated. The better results obtained are another illustration of how the removal of occluded or bound calcium from fiber surfaces gave clean fibers for dyeing.

SOAPING DYEINGS ——— Continuous soaping of fabrics presents a finisher with many problems. Woolen and worsted piece goods are blends of fleece and/or lime-pulled wools, so there are lime soaps to be removed whether or not a synthetic detergent is employed in scouring raw wool. A 12-strand 9-section washer allows 4 to 10 minutes contact in each soap section. This contact time varies with the weight of the fabric. It is then necessary to remove the lime soaps in this short time, and here is where rates of reaction and stability are far more important than calcium repression values. Many compounds will sequester the calcium, but will their performance fit the set of conditions in continuous soaping? Efficient chelation by Versene of insoluble calcium soaps regardless of alkalinity or temperature is added assurance of effective scouring for good fiber preparation.

The soaping-off of dyed and printed goods where production rates are of the order of 100 yd per minute requires efficient performance of scouring chemicals. Since TSPP is the best builder to obtain higher detergent action from synthetics, it is obvious that extending its useful life will counteract "drag-out" and redeposition of soil. The combination of TSPP and Versene in a soaping formula should improve scouring to reduce "redye" and mark-off on dyed and printed goods. The same improvement is obtained with Versene in jig scouring.

CONCLUSION

There are many other processes wherein chelation is now an integral part. This holds true because heavy metal ions that go unhampered into side reactions often constitute the "bugs" that impair the critical chemical processing of textiles. As chelation with EDTA is still a novel approach for some, the information presented here is meant to help you in applying the chemistry of chelation to wet-finishing or dyeing operations. We wish to stress again that rates of reactions or the speed of chelation and stability of the complexing agent are far more important than calcium repression values. Efficiency of chelation should become your yardstick in selecting a sequestering agent from the many available for your wet-finishing process.

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(2) Wilson, J A, *J Am L Chem Assoc*, 494 (1937).
(3) Thilo, *Angew Chemie* 64, 163 (1951).
(4) Singer, J J and Bersworth, F C, *Am Dyestuff Reptr* 41, P365 (1952).
(5) Bulletin No. 3, *Hexagon Digest* (ICI publication).

TESTS FOR COLORFASTNESS OF TEXTILES UNDER CONSIDERATION IN THE INTERNATIONAL ORGANIZATION FOR STANDARIZATION

WILLIAM D APPEL

American Standards Association
Committee L23
American Committee on ISO/TC 38—Textiles

FOREWORD

THE tests for colorfastness of textiles presented here are the result of co-operative work in the International Organization for Standardization (ISO) during the past five years. They are now under consideration in the 33 countries represented on ISO Technical Committee 38 on Textiles (TC 38) and it is expected that formal approval of them for international use will be sought next year. They are published here for information and comment. Comments may be addressed to Leonard S Little, Suite 1500, 101 West 31st Street, New York 1, N Y, leader of a group of over 20 individuals responsible for formulating the US viewpoint on colorfastness tests, or to the Secretary, ASA Committee L23, American Standards Association, 70 East 45th Street, New York 17, N Y.

The methods do not at present cover all of the agents for which fastness tests are required. Work is in progress on other tests, including in particular tests for colorfastness to laundering.

The ISO was organized in 1946 to succeed the United Nations Standardization Co-ordinating Commission set up by the United Nations Organization during the war. Membership is open to the national standardizing body in each interested country. The American Standards Association is the member for the U S. At present some 34 countries are members of ISO and over 70 technical committees have been formed to deal with a diverse range of subjects.

ISO Technical Committee 38 on Textiles has a number of subcommittees and working groups. One of them, Subcommittee No. 1, deals specifically with colorfastness testing. The Secretariat of this subcommittee is shared jointly by the USA and the United Kingdom. The work in these countries has been the primary responsibility of the AATCC and the Society of Dyers and Colourists, respectively. They act as focal points for the conduct of negotiations and collaborate with the other international bodies concerned, through the American Standards Association and the British Standards Institution.

Colorfastness testing was discussed in general terms at the first meeting of ISO/TC 38 at Buxton, England in 1948 and subsequently by correspondence between the interested countries and by personal contact. At the second meeting of the Textiles Committee held at Bournemouth, England in 1951 there were several sessions of Subcommittee 1 at which a range of fastness tests were discussed and an encouraging measure of agreement was reached. In November 1952, a series of meetings of Subcommittee 1 was held in New York when further progress was made.

The tests which are now put forward as proposed international standards are the outcome of continuous negotiations and effort on the part of the European continental fastness committees, the Society of Dyers and Colourists, and AATCC. All of these bodies have been very active during the last few years and each has carried on independent investigations, not only with the immediate object of establishing national tests, but with the wider intention of securing agreement on a series of tests that could be accepted throughout the world.

The continental group has representation from most of the countries in continental Europe and the Society of Dyers and Colourists has been represented at its meetings. The fastness committees of Germany, France, and Switzerland called an international meeting at Basel in February 1951 with the object of establishing fastness tests for the European continent. At a second meeting in Paris in April 1952 it was agreed to form the ECE (Europaisch-Continentale Echtheits-Convention, or Groupement d'Etudes Continental Européen pour la Solidité des Teintures et Impressions). A third international meeting was held under the auspices of the ECE at Bad Kissingen, Germany, in April 1953. At this conference the ECE decided that the tests they had worked out should be adopted immediately by their members but that they should be superseded by ISO tests as soon as these had been formally accepted by ISO/TC 38.

The AATCC has been kept informed in regard to these conferences abroad and has had most friendly and co-operative relations with the continental committees, the Society of Dyers and Colourists, and key individuals in them through correspondence and personal contacts.

The proposed ISO tests which follow are the product of the effort of SC 1 to provide a set of methods suitable for use in all of the countries.*

* Information about the work of ISO/TC 38 may be obtained from Committee L23, American Standards Association, 70 East 45th Street, New York 17, N Y. Reports on the meetings at Buxton (1948) and Bournemouth (1951) may be consulted in the offices of the Association.

Also see—Little, Leonard S, "AATCC Participation in European Textile Conferences in 1951: Part II, Progress Made in International Colorfastness Standard Test Methods", *Am Dyestuff Reptr* 40, No. 23 (Nov 12, 1951), pp P732-P735; and Appel, William D, "International Co-operation on Standardization of Textile Testing Methods", *J Home Econ* 44, No. 10 (December, 1952).

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No. 31

COLORFASTNESS OF TEXTILES: GENERAL PRINCIPLES OF TESTING

1. INTRODUCTION

1.1 This standard provides general information about the methods for testing colorfastness of textiles for the guidance of users. The uses and limitations of the methods are pointed out, several terms are defined, an outline of the form of the methods is given, and the content of each section discussed. Procedures common to a number of the methods are discussed briefly.

1.2 By *"Colorfastness"* is meant the resistance of the color of textiles to the different agencies to which textiles may be exposed during manufacture and subsequent use.

1.3 The methods may be used not only for evaluating colorfastness of textiles, but also for evaluating colorfastness of dyestuffs. When so used, the dyestuff is applied to the textile in specified depths of color by stated procedures and the textile is then tested in the usual way.

1.4 Each method is concerned with colorfastness to a single agency. No directions are given for testing fastness to a succession of agencies as the agencies of interest in a particular case and the order of application will vary.

1.5 The conditions in the tests have been chosen to correspond closely to treatments usually employed in manufacture and to conditions of ordinary use. At the same time they have been kept as simple and reproducible as possible. As the tests cannot hope to duplicate all of the conditions under which textiles are processed or used, the fastness ratings must be interpreted according to the particular needs of each user. They provide, however, a common basis for testing and reporting colorfastness.

2. GENERAL PRINCIPLE

2.1 A specimen of the textile to be tested, with undyed cloth attached if staining is to be rated, is subjected to the action of the agency in question. The extent of any change in color and of any staining of the undyed cloth are evaluated and expressed in fastness numbers.

3. OUTLINE OF FORM OF THE METHODS

3.1 The headings of the principal sections of the methods follow:

Purpose and Scope
Principle
Apparatus and Reagents
Specimen
Procedure
Report
Notes

4. PURPOSE AND SCOPE

4.1 Under this heading in each method are given the intended use of the method, its limitations, and definitions of any terms that may not be clear.

5. PRINCIPLE OF INDIVIDUAL METHODS

5.1 A concise statement of the principle of the method is given to enable the user to decide whether the method is what he is seeking.

6. APPARATUS AND REAGENTS

6.1 The equipment and supplies required for the test are enumerated.

6.2 *Test Solutions.*—Distilled water is to be used for making test solutions. The concentrations of baths are given in milliliters per liter (ml/l) or grams per liter (g/l). The quantities of chemicals used are given in each method. For crystalline substances, the amount of water of crystallization is given, and for liquids, the density.

7. SPECIMEN

7.1 Directions are given for the preparation of the "specimen" or "composite specimen" to be tested and "test-control specimens" to be used.

7.2 By *"specimen"* is meant the small piece of material, usually taken from a larger sample or lot, that is to be submitted to the test.

7.3 By *"composite specimen"* is meant the specimen with attached undyed cloth used for evaluating staining.

7.4 By *"test-control specimen"* is meant a specimen of known behavior used to insure the carrying out of a test correctly.

7.5 *Piece goods.*—Specimens from woven and knit fabrics, felts, and other piece goods should be free from creases so that the treatment they receive may result in uniform action over the whole area.

7.6 *Yarns.*—Yarns to be tested may be knit into fabric from which a specimen is taken. They may be wound parallel, for example on a U-shaped wire frame, and then sewn between the undyed cloths. For dry treatments, close winding on a card is recommended. For certain wet treatments without accompanying undyed material, hanks of yarn may be used, tied at both ends.

7.7 *Fibers.*—Fibers may be tested by combing and compressing into a flat pad which may then be sewn between the white cloths.

7.8 *Undyed cloth for staining.*—

7.8.1 The undyed cloth to be used for evaluating staining, if not otherwise specified, should be plain weave, medium weight, and free from finishes, residual chemicals, and chemically damaged fibers. Cotton and linen should be bleached; other materials should be cleaned to their usual degree of whiteness without bleaching.

7.8.2 The fluidity value of the cotton cloth used for staining may not exceed 5 rhes when measured in the standard cuprammonium solution by the method of Clibbens and Geake.

References: *J Textile Inst* 19 T77 (1928).

8. CONDITIONING

8.1 Special conditioning of specimens usually is not necessary, but specimens and the undyed cloths used with them, should be neither moist nor very dry. Tests in which differences in moisture content of the specimen and undyed cloths will influence the results should be in standard condition, i e, in moisture equilibrium with air having a temperature of 20° C ± 2° C (68° F ± 4° F) and relative humidity of 65% ± 2%.

9. PROCEDURE

9.1 The series of operations through which the specimen is taken are described including the evaluation of color change and staining of undyed cloth. The use of test-control speci-

mens is called for in some of the methods to insure the carrying out of the tests correctly.

9.2 *Tolerances.*—Tolerances are given for numerical values of dimensions, temperatures, and times that are considered critical. If no tolerance is given, the precision of the measurements need be only that to be expected when using common instruments and reasonable care. The precision is further indicated by the number of significant figures in the values given.

9.3 *Liquor ratio.*—By "liquor ratio" is meant the ratio of the volume of the liquor used in the treatment expressed in milliliters to the weight of the specimen or composite specimen (specimen plus undyed material) expressed in grams.

9.4 *Wetting out.*—Special care must be taken when wetting specimens that they are uniformly saturated. In particular, when wool or materials containing wool are to be wet-out, it is necessary for them to be thoroughly kneaded by hand, with the flattened end of a glass rod, or with a mechanical device.

9.5 *Spotting.*—For tests in which the material is spotted with water or a reagent and the drop worked in with a glass rod, care should be taken not to raise the surface of the material, otherwise there will be a change in the light reflection and hence in appearance.

9.6 *Wetting to 100% add-on.*—When the material is to be wetted to contain its own weight of liquor, it may be saturated with the liquor and then drawn between two rubber rollers, squeezed by means of a rubber roller on a glass plate, or centrifuged. Wringing by hand does not give uniform wetting.

9.7 *Temperature.*—Temperatures are given in degrees centigrade (°C), usually with a tolerance of plus or minus 2 degrees (± 2° C). For reliable results, continuous temperature control is essential.

10. EVALUATION OF COLORFASTNESS

10.1 Colorfastness with respect to change in color of the specimen in the test and to staining of undyed materials are evaluated separately. Specimens and undyed cloths should have cooled after drying and have regained their normal moisture content before the evaluation.

10.2 *Colorfastness with respect to change in color.*—The change which occurs in a test may be a change in depth of color, a change in hue, a change in brightness or any combination of these. Regardless of the character of the change, the evaluation is based upon the magnitude of the visual contrast between two colored areas, one being the original material, the other the tested specimen. This contrast is compared visually with the contrasts represented by the 5 pairs of neutral color chips (or swatches of cloth) in the standard Gray Scale specified for the purpose in Test No. 32. Each step of the scale hears a fastness number running from 5, no contrast, to 1, a large contrast. The fastness rating of the specimen is that number of the Gray Scale which corresponds to the contrast between the original and treated specimen. If the latter lies between two of the controls of the Scale, the specimen is given an intermediate rating, e g, 4-3, or 3-4, but intermediate ratings are unnecessary when the fastness is less than 3. A rating of 5 is given only when there is practically no difference between the tested specimen and the original material.

10.3 *Colorfastness with respect to staining.*—The degree of staining of the undyed cloth either by absorption of dye from the bath or by direct transfer of color from the specimen is evaluated by visual inspection of the side of the undyed cloth which was in contact with the specimen. The color of the bath is ignored. The standard Gray Scale for evaluating staining is used. It is specified in Test No. 33. The steps of this Scale run from 5, no contrast, represented by a pair of white chips (or swatches of cloth) to 1, a large contrast, represented by a white and a gray chip. The contrast between the original undyed cloth and that stained as a result of the test is rated with the aid of the Scale in a similar way to that described for change in color in section 10.2. Staining is evaluated without reference to the depth of color of the material tested. The staining is evaluated for each type of undyed material in the test.

10.4 *Influence of pretreatments and aftertreatments.*—It is well known that certain pretreatments and aftertreatments affect the fastness properties of colored textiles. Thus any change in a colored material that takes place as a result of applying a fastness test may not necessarily be due to lack of fastness in the dye itself.

11. CONDITIONS OF VIEWING AND ILLUMINATION IN EVALUATING COLORFASTNESS

11.1 In evaluating colorfastness, a piece of the original material and the tested specimen, or the undyed and stained cloths, are arranged side by side in the same plane and oriented in the same direction. Two or more layers are used if necessary to avoid effects of other backing on the appearance. The appropriate Gray Scale is placed nearby in the same plane. The surrounding field is uniform gray of a brightness slightly less than that of the darkest member of the Gray Scale for evaluating change in color. The surfaces to be compared are illuminated by north sky light in the Northern Hemisphere, south sky light in the Southern Hemisphere, or equivalent source with illumination of 50 foot-candles or more. The light is incident upon the surfaces at approximately 45° and direction of viewing is approximately along the perpendicular to the plane of the surfaces.

12. REPORT

12.1 The information to be supplied in the report of the test is indicated under this heading in the methods.

13. NOTES

13.1 Sources of supply of materials called for in the tests, references to literature, and other information not considered necessary for inclusion in the body of the test method, are given under "Notes".

No. 32

COLORFASTNESS: GRAY SCALE FOR EVALUATING CHANGE IN COLOR

1. PURPOSE AND SCOPE

1.1 This standard describes the Gray Scale for evaluating changes in color of textiles in colorfastness tests and its use. A precise colorimetric specification of the Scale is given as a permanent record against which newly prepared working standards and standards that may have changed can be compared (See 4.1).

2. GRAY SCALE FOR EVALUATING CHANGE IN COLOR

2.1 *The Scale* consists of 5 pairs of gray color chips (or swatches of gray cloth) each representing a visual difference in color or contrast. The difference represented* and corresponding numerical fastness ratings are as follows:

* The next draft of the method will refer to the Adams chromatic value formula by which the color differences are calculated and to literature on the formula and its use.

Color Differences in NBS Units (Judds) (See 4.2)	Fastness Rating
0	5
1½	4
3	3
6	2
12	1

2.2 *Fastness Rating 5* is represented on the scale by two identical chips (or swatches) mounted side by side, neutral gray in color and having a reflectance of 12 ± 1% (See Sec 3). The color difference is 0.

2.3 *Fastness Ratings 4 to 1, inclusive,* are represented by a "reference" chip (or swatch) identical with those used for Grade 5, paired with similar but lighter neutral gray chips (or swatches), the visual differences in the pairs being in geometric steps of color difference, or contrast, as shown in the table.

2.4 *Use of the Scale.*—Place a part of the original textile and the tested specimen of it side by side in the same plane and oriented in the same direction. Place the Gray Scale nearby in the same plane. The surrounding field should be uniform gray of a brightness slightly less than that of the darkest member of the Gray Scale. If necessary to avoid effects of the backing on the appearance of the textiles, use two or more layers of the original textile under both original and tested specimen. Illuminate the surfaces with north sky light in the Northern Hemisphere, south sky light in the Southern Hemisphere, or equivalent source with illumination of 50 foot-candles or more. The light should be incident upon the surfaces at approximately 45° and the direction of viewing approximately perpendicular to the plane of the surfaces. Compare the visual difference between original and tested textile with the differences represented by the Gray Scale. The fastness rating of the specimen is that number of the Gray Scale, which corresponds to the contrast between the original and treated specimens. If the latter lies between two of the contrasts of the Scale, the specimen is given an intermediate assessment, e g, 4-3 or 3-4, but intermediate classification is unnecessary when the fastness is less than 3. A rating of 5 is given only when there is no difference between the tested specimen and the original material.

2.5 Describing color changes in fastness tests.

2.5.1 In using the Gray Scale as outlined in 2.4, the character of the change in color, whether in hue, depth, brightness, or any combination of these is not rated, the overall difference, or contrast, between original and tested specimen is the basis for the evaluation.

2.5.2 If, as in rating dyestuffs on textiles, for example, it is desired to record the character of the change in color of the textile in the test, appropriate qualitative terms may be added to the numerical rating, as illustrated by the following examples:

Rating	Meaning
3	contrast equal to Grade 3 of the Gray Scale — change is a loss in depth of color only.
3 redder	contrast equal to Grade 3 of the Gray Scale — no significant loss in depth, but color has become redder.
3 weaker, yellower	contrast equal to Grade 3 of the Gray Scale — loss in depth and change in hue have occurred.
3 weaker, bluer, duller	contrast equal to Grade 3 of the Gray Scale — loss in depth and change in both hue and brightness have occurred.
4-5 redder	contrast intermediate between 4 and 5 of the Gray Scale — no significant loss in depth but color has become slightly redder.

2.5.3 When changes in color occur in two or three directions it is considered neither feasible nor necessary to indicate the relative magnitude of each change, either in words (such as "much" or "little") or by number (e g, 1=small, 3=large), or even by putting the larger change first (i e, "bluer, duller" being different from "duller, bluer").

3. COLORIMETRIC SPECIFICATION OF THE GRAY SCALE

3.1 The precise colorimetric specification of the standard gray colors of the scale given in this section is derived from section 2.

3.2 Actual Gray Scales used as working standards should approximate these colors closely, particularly in color spacing.

3.3 The tristimulus values for the gray colors for 45° illuminating and normal viewing under CIE standard source C are given in the following table (See 4.3):

Fastness Rating	Tristimulus values for 45-normal illuminating and viewing under CIE standard source C						NBS units of color difference
	First Color			Second Color			
	X	Y	Z	X	Y	Z	Judd
5	0.1176	0.1200	0.1417	0.1176	0.1200	0.1417	0.0
4	.1176	.1200	.1417	.1280	.1306	.1543	1.5
3	.1176	.1200	.1417	.1389	.1417	.1673	3.0
2	.1176	.1200	.1417	.1620	.1652	.1951	6.0
1	.1176	.1200	.1417	.2132	.2175	.2569	12.0

4. NOTES AND REFERENCES*

* Sections 4.2 and 4.3 were omitted from this draft through an oversight. 4.2 will refer to literature on the Adams formula for calculating the color differences and 4.3 will read: Commission Internationale de l' Eclairage, Proceedings of the eighth session, Cambridge, England, p 19 to 29 (September 1931).

4.1 Gray scales may be obtained from:

Deutsche Echtheitskommission, Adlerstrasse 18, Krefeld, Germany

Society of Dyers and Colourists, 19 Piccadilly, Bradford, Yorkshire, England

American Association of Textile Chemists and Colorists, Lowell Technological Institute, Lowell, Mass.

No. 33

COLORFASTNESS: GRAY SCALE FOR EVALUATING STAINING

1. PURPOSE AND SCOPE

1.1 This standard describes the Gray Scale for evaluating staining of undyed textiles in colorfastness tests and its use. A precise colorimetric specification of the Scale is given as a permanent record against which newly prepared working standards and standards that may have changed can be prepared (See 4.1).

2. GRAY SCALE FOR EVALUATING STAINING

2.1 *The Scale* consists of 5 pairs of gray or white color chips (or swatches of gray or white cloth) each representing a visual difference in color or contrast. The differences represented* and corresponding numerical fastness ratings are as follows:

* See note to Section 2.1, Method No. 32.

Color Differences in NBS Units (Judds) (See 4.2)	Fastness Rating
0	5
4	4
8	3
16	2
32	1

2.2 *Fastness Rating 5* is represented on the scale by two identical chips (or swatches) mounted side by side, having a reflectance of not less than 85%. The color difference is 0.

2.3 *Fastness Ratings 4 to 1, inclusive,* are represented by a reference chip (or swatch) identical with those used for rating 5, paired with similar but neutral gray chips (or swatches), the visual differences in the pairs being in geometric steps of color difference, or contrast, as shown in the table.

2.4 *Use of the Scale.*—Place a piece of the unstained undyed textile and the stained piece of it side by side in the same plane and oriented in the same direction. Place the Gray Scale nearby in the same plane. The surrounding field should be uniform gray of a brightness slightly less than that of the darkest member of the Gray Scale for evaluating change in color. If necessary to avoid effects of the backing on the appearance of the textiles, use two or more layers of the unstained undyed textile under both unstained and stained piece. Illuminate the surfaces with north sky light in the Northern Hemisphere, south sky light in the Southern Hemisphere, or equivalent source of illumination of 50 footcandles or more. The light should be incident upon the surfaces at approximately 45° and the direction of viewing approximately perpendicular to the plane of the surfaces. Compare the visual difference between original undyed and stained pieces with the differences represented by the Gray Scale. The fastness rating of the specimen is that number of the Gray Scale which corresponds to the contrast between the original and treated specimens. If the latter lies between two of the contrasts of the Scale, the specimen is given an intermediate assessment, e g, 4-3 or 3-4, but intermediate classification is unnecessary when the fastness is less than 3. A rating of 5 is given only where there is no difference between the tested specimen and the original material.

3. COLORIMETRIC SPECIFICATION OF THE GRAY SCALE

3.1 The precise colorimetric specification of the standard gray colors of the scale given in this section is derived from section 2.

3.2 Actual Gray Scales used as working standards should approximate these colors closely, particularly in color spacing.

3.3 The tristimulus values for the gray colors for 45° illuminating and normal viewing under CIE standard source C are given in the following table (See 4.3).

Fastness Rating	*Tristimulus values for 45-normal illuminating and viewing under CIE standard source C*						*NBS units of color difference*
	First Color			*Second Color*			*Judd*
	X	Y	Z	X	Y	Z	
5							
4							
3	(To be inserted)						
2							
1							

4. NOTES AND REFERENCES*

*The editorial note to Section 4 in Method No. 32 applies here also.

4.1 Gray Scales may be obtained from:

Germany, Deutsche Echtheitskommission, Krefeld, Adlerstrasse 18.

England, Society of Dyers and Colourists, 19 Piccadilly, Bradford, Yorkshire.

USA, American Association of Textile Chemists and Colorists, Lowell Technological Institute, Lowell, Massachusetts.

No. 34

COLORFASTNESS TO ACID SPOTTING

1. PURPOSE AND SCOPE

1.1 This method is intended for evaluating the resistance of the color of textiles of all kinds in all forms to the action of dilute solutions of organic and mineral acids.

1.2 Three tests differing in severity are provided. Any or all may be used depending upon the nature of the fiber.

2. PRINCIPLE

2.1 Drops of the acid solution are worked into the textile with a glass rod and the changes in color of the textile while it is still wet and after drying are assessed with a standard Gray Scale.

3. APPARATUS AND REAGENTS

3.1 Pipette or dropper.

3.2 Glass rod with rounded end.

3.3 Gray Scale for evaluating change in color (See 7.1).

3.4 Acetic acid solution containing 300 g glacial acetic acid per liter.

3.5 Sulfuric acid solution containing 50 g concentrated sulfuric acid (sp gr 1.84) per liter.

3.6 Tartaric acid solution containing 100 g tartaric acid per liter. (Especially for acetate fiber instead of acetic acid.)

4. SPECIMEN

4.1 If the textile to be tested is cloth, a piece at least 10 cm x 4 cm is required.

4.2 If the textile to be tested is yarn, knit it into cloth and use a piece at least 10 cm x 4 cm or from a number of lengths of it form a wick 10 cm long and 0.5 cm in diameter tied at both ends.

4.3 If the textile to be tested is bulk fiber, comb and compress enough of it to form a sheet at least 10 cm by 4 cm.

5. PROCEDURE

5.1 Spot the specimen with two drops of the appropriate solution at 25° C ± 2° C (77° F ± 4° F). Work the drops into the specimen with the glass rod.

5.2 Dry the specimen in air at 25° C ± 2° C (77° F ± 4° F).

5.3 Evaluate the change in color with the Gray Scale (See 7.1).

6. REPORT

6.1 Report the numerical rating for change in color for each kind of acid used (and for change in color when wet if of interest).

7. NOTES

7.1 See the following documents:

(a) Test No. 31.

(b) Test No. 32.

7.2 The change in color of the specimen after it has been wet for 10 minutes may be observed. It is of interest for the evaluation of dyestuffs.

No. 35

COLORFASTNESS TO ALKALI SPOTTING

1. PURPOSE AND SCOPE

1.1 This method is intended for evaluating the resistance of the color of textiles of all kinds in all forms to the action of dilute alkaline solutions.

2. PRINCIPLE

2.1 Drops of a sodium carbonate solution are worked into the textile with a glass rod and the change in color is evaluated with a standard Gray Scale.

3. APPARATUS AND REAGENTS

3.1 Pipette or dropper.

3.2 Glass rod with rounded end.

3.3 Gray Scale for evaluating change in color (See 7.1).

3.4 Sodium carbonate solution containing 100 g anhydrous sodium carbonate per liter.

4. SPECIMEN

4.1 If the textile to be tested is cloth, a piece at least 10 cm x 4 cm is required.

4.2 If the textile to be tested is yarn, knit it into cloth and use a piece at least 10 cm x 4 cm or from a number of lengths of it form a wick 10 cm long and 0.5 cm in diameter tied at both ends.

4.3 If the textile to be tested is bulk fiber, comb and compress enough of it to form a sheet at least 10 cm by 4 cm.

5. PROCEDURE

5.1 Spot the specimen with two drops of the sodium carbonate solution at 25° C ± 2° C (77° F ± 4° F). Work the drops into the specimen with the glass rod. If penetration does not take place readily, immerse the specimen in the solution and squeeze so as to leave its own weight of solution in it. Dry the specimen in air at 25° C ± 2° C (77° F ± 4° F). Brush it to remove sodium carbonate residues.

5.2 Evaluate the change in color with the Gray Scale (See 7.1).

6. REPORT

6.1 Report the numerical rating for change in color.

7. NOTE

7.1 See the following documents:

(a) Test No. 31.

(b) Test No. 32.

No. 36

COLORFASTNESS TO BLEACHING, HYPOCHLORITE

1. PURPOSE AND SCOPE

1.1 This method is intended for evaluating the resistance of the color of natural and regenerated cellulose textiles in all forms to the action of bleaching baths containing sodium and calcium hypochlorite in concentrations normally used in commercial bleaching.

2. PRINCIPLE

2.1 A specimen of the textile is agitated in a sodium hypochlorite solution, rinsed in water, agitated in sodium bisulphite solution, rinsed and dried. The change in color is evaluated with a standard Gray Scale.

3. APPARATUS AND REAGENTS

3.1 Sodium hypochlorite solution containing 2 g of available chlorine per liter, buffered at pH 11.0 ± 0.2 with 10 g anhydrous sodium carbonate per liter, temperature 25° C ± 2° C (77° F ± 4° F). Weight of solution used to be 50 times that of the specimen. Sodium hypochlorite of the following composition shall be used:

sodium hypochlorite	NaOCl	14% to 16%
sodium chloride	NaCl	12% to 17%
sodium hydroxide	NaOH	2.0% maximum
sodium carbonate	Na_2CO_3	2.0% maximum
iron	Fe	0.001% maximum

3.2 Sodium bisulfite solution containing 5 g $NaHSO_3$ per liter. Weight of solution used to be 50 times the weight of the specimen.

3.3 Container for specimen and bleaching solution that can be closed (See 5.1).

3.4 Gray Scale for evaluating change in color.

4. SPECIMEN

4.1 If the textile to be tested is fabric, use a specimen at least 10 cm x 4 cm (4 inches x 1.5 inches).

4.2 If the textile to be tested is yarn, knit it into a fabric and use a specimen of it at least 10 cm x 4 cm or make a wick of parallel lengths 10 cm (4 inches) long and about 0.5 cm (3/16 inch) in diameter tied near both ends.

4.3 If the textile to be tested is fiber, comb and compress some of it into a sheet at least 10 cm x 4 cm and sew the sheet on a piece of unbleached, desized cotton cloth to support the fibers.

5. PROCEDURE

5.1 Wet out the specimen in distilled water, remove the excess water, and place the specimen in an open or loosely rolled form in the sodium hypochlorite solution (3.1). Close the container and keep the specimen in the solution at 25° C ± 2° C (77° F ± 4° F) for 60 minutes. Avoid exposure to direct sunlight.

5.2 Wash the specimen thoroughly in cold running water and then stir it for 10 minutes in the sodium bisulphite solution at 25° C ± 2° C (77° F ± 4° F).

5.3 Wash the specimen thoroughly in cold running water, remove the excess water, and dry the specimen in air at a maximum temperature of 60° C (140° F).

5.4 Evaluate the change in color of the specimen with the Gray Scale (See 7.1).

6. REPORT

6.1 Report the numerical rating for change in color.

7. NOTES

7.1 See the following documents:

(a) Test No. 31.

(b) Test No. 32.

No. 37

COLORFASTNESS TO BLEACHING, PEROXIDE

1. PURPOSE AND SCOPE

1.1 This method is intended for evaluating the resistance of the color of textiles of all kinds except polyamide, in all forms, to the action of bleach baths containing peroxide in concentrations commonly employed in textile processing.

2. PRINCIPLE

2.1 A specimen of the textile in contact with specified undyed cloths is immersed in the bleaching solution, rinsed, dried, and the change in color and staining are evaluated with standard Gray Scales.

3. APPARATUS AND REAGENTS

3.1 Test tube, diameter and length such that the test specimen roll will have a reasonably snug fit in the tube and be covered by the bleach solution.

3.2 Reflux condenser, fitting the test tube, may be used to reduce evaporation from the bleach bath during the test.

3.3 Bleach bath of the composition given in Table I.

3.4 Two undyed cloths, each 10 cm x 4 cm, one piece made of the same kind of fiber as that in the textile to be tested, the second piece made of the fiber indicated in Table II, or as otherwise specified (See 7.1).

3.5 Gray Scales for evaluating the change in color and the staining of the white cloths (See 7.2).

4. SPECIMEN

4.1 If the textile to be tested is cloth, place a 10 cm x 4 cm (about 4 x 1½ inch) specimen of it between the two pieces of undyed cloth (3.3), and sew along all four sides to form a composite specimen.

TABLE I
COMPOSITION OF BLEACH BATH AND CONDITIONS OF USE

Starting Bath, per liter of distilled water	*Bath 1 for natural and regenerated cellulose*	*Bath 2 for natural and regenerated cellulose*	*Bath 3 for wool and acetate*	*Bath 4 for silk*
Hydrogen peroxide[1], ml	5	—	20	20
Sodium peroxide[2], g	0	3	—	—
Sodium silicate[3], ml	5	—	—	5
Sodium pyrophosphate[4], g	—	—	5	—
Magnesium chloride[5], g	0.01*	—	—	0.01*
pH, initial value ± 0.2[6]	10.5	11.5	9.3	10.0
Temperature, ° C ± 2°	90	80	50	70
Temperature, ° F ± 4°	194	176	122	158
Duration of treatment, hours	1	1	2	2
Liquor ratio, vol of liquor in ml: weight of cloth in g	30:1	30:1	30:1	30:1

[1] 30% H_2O_2 by volume
[2] 100% Na_2O_2
[3] About 26% SiO_2 and 10% Na_2O, d 1.32, 35° Be
[4] $Na_4P_2O_7 \cdot 10\ H_2O$
[5] $MgCl_2$
[6] Adjust by addition of NaOH solution, if necessary

* It appears that this value should be 0.1 rather than 0.01

TABLE II

If First Piece is:	*Second Piece to be:*
wool, silk, linen, viscose rayon	cotton
cotton, acetate	viscose rayon

4.2 If the textile to be tested is yarn, knit it into cloth and treat it as in 4.1, or form a layer of parallel lengths of it between the two undyed cloths, and sew around the four sides to hold the yarns in place.

4.3 If the textile to be tested is fiber, comb and compress some of it into a sheet 10 cm x 4 cm in size, place the sheet between the two undyed cloths, and sew around the four sides to form a composite specimen.

5. PROCEDURE

5.1 Loosely roll the composite specimen in the direction of the long edge, place the 4 cm roll in the test tube, in the appropriate bleach solution (Table I), and keep it well covered for the time and at the temperature indicated in the table.

5.2 Remove the specimen, rinse it for 10 minutes in flowing cold tap water and squeeze it. Remove the stitching on two long sides and one short side, open it out, and dry at a temperature not exceeding 60° C (140° F) with the three parts in contact only at the one line of stitching.

5.3 Evaluate the change in color of the specimen and the staining of the undyed cloths with the appropriate standard Gray Scales (7.2).

6. REPORT

6.1 Report the bleach solution used, the numerical rating for color change, and the numerical rating for staining of each kind of undyed fiber tested.

7. NOTES

7.1 The undyed cloths should be plain weave, medium weight, and free from finishes, residual chemicals, and chemically damaged fibers. Cotton and linen should be bleached; other materials should be cleaned to their usual degree of whiteness without bleaching.

7.2 See the following documents:
(a) Test No. 31.
(b) Test No. 32.
(c) Test No. 33.

No. 38

COLORFASTNESS TO CARBONIZING WITH ALUMINUM CHLORIDE

1. PURPOSE AND SCOPE

1.1 This method is intended for evaluating the resistance of the color of wool and part wool textiles to the manufacturing operation designed to remove vegetable impurities by treatment with aluminum chloride at high temperatures. In particular, it is used for wool textiles containing acetate of polyamide fibers.

2. PRINCIPLE

2.1 A specimen containing the aluminum chloride solution is dried and baked, rinsed and neutralized, and the changes in color after rinsing, neutralizing, and drying are evaluated with a standard Gray Scale.

3. APPARATUS AND REAGENTS

3.1 Oven for drying specimens in air at 60° C ± 2° C (140° F ± 4° F) and baking in air at 115° C ± 2° C (239° F ± 4° F).

3.2 Aluminum chloride solution (sp gr 1.037) containing 51.4 g Al_2Cl_6 per liter.

3.3 Ammonium hydroxide solution containing 2 ml of 20% NH_4OH per liter.

3.4 Gray Scale for assessing change in color (See 7.1).

4. SPECIMEN

4.1 If the textile to be tested is cloth, a piece at least 10 cm x 4 cm is required.

4.2 If the textile to be tested is yarn, knit it into cloth and use a piece at least 10 cm x 4 cm or from a number of lengths of it form a wick 10 cm long and 0.5 cm in diameter tied at both ends.

4.3 If the textile to be tested is bulk fiber, comb and compress enough of it to form a sheet at least 10 cm by 4 cm.

5. PROCEDURE

5.1 Immerse the specimen in the aluminum chloride solution for 15 minutes at 25° C ± 2° C (77° F ± 4° F) liquor ratio 20:1. Squeeze it to leave in 80% of its weight of solution.

5.2 Dry the specimen by hanging it in an oven for 3 minutes, or longer if necessary, at 60° C ± 2° C (140° ± 4° F). Then bake it by heating for 15 minutes at 115°

± 2° C (239° F ± 2° F).

5.3 Rinse the specimen for 5 minutes in cold, running water and then divide it into two equal parts. Dry one half in air at a temperature not exceeding 60° C (140° F).

5.4 Agitate the other half for 30 minutes at 25° C ± 2° C (77° F ± 4° F) in the ammonium hydroxide solution, liquor ratio 40:1. Then rinse it for 5 minutes in cold running water and dry it in air at a temperature not exceeding 60° C (140° F).

5.5 Assess the change in color of each half of the specimen with the Gray Scale (See 7.1).

6. REPORT

6.1 Report the numerical rating for change in color for both the rinsed and the neutralized portions of the specimen.

7. NOTES

7.1 See the following documents:

(a) Test No. 31.

(b) Test No. 32.

No. 39

COLORFASTNESS TO CARBONIZING WITH SULFURIC ACID

1. PURPOSE AND SCOPE

1.1 This method is intended for evaluating the resistance of the color of wool and part wool textiles to the manufacturing operation designed to remove vegetable impurities by treatment with sulfuric acid at high temperatures.

2. PRINCIPLE

2.1 A specimen containing the sulfuric acid solution is dried and baked, rinsed and neutralized, and the changes in color after rinsing, neutralizing, and drying are evaluated with a standard Gray Scale.

3. APPARATUS AND REAGENTS

3.1 Oven for drying specimens in air at 60° C ± 2° C (140° F ± 4° F) and baking in air at 105° C ± 2° C (221° F ± 4° F).

3.2 Sulfuric acid solution containing 50 g concentrated sulfuric acid (sp gr 1.84) per liter.

3.3 Sodium carbonate solution containing 2 g anhydrous sodium carbonate per liter.

3.4 Test-control (to be inserted) (See 7.1).

3.5 Gray Scale for assessing change in color (See 7.2).

4. SPECIMEN

4.1 If the textile to be tested is cloth, a piece at least 10 cm x 4 cm is required.

4.2 If the textile to be tested is yarn, knit it into cloth and use a piece at least 10 cm x 4 cm or from a number of lengths of it form a wick 10 cm long and 0.5 cm in diameter tied at both ends.

4.3 If the textile to be tested is bulk fiber, comb and compress enough of it to form a sheet at least 10 cm by 10 cm.

5. PROCEDURE

5.1 Carry out the operations described in 5.2 to 5.7 inclusive with the composite specimen and the composite test-control specimen in parallel, in separate baths.

5.2 Immerse the specimen in the sulfuric acid solution for 5 minutes at 25° C ± 2° C (77° F ± 4° F) liquor ratio 20:1. Squeeze it to leave in 80% of its weight of solution.

5.3 Dry the specimen by hanging it in an oven for 30 minutes, or longer if necessary, at 60° C ± 2° C (140° F ± 4° F). Then bake it by heating for 15 minutes at 105° C ± 2° C (221° F ± 4° F).

5.4 Rinse the specimen for 5 minutes in cold, running water and then divide it into two equal parts. Dry one half in air at a temperature not exceeding 60° C (140° F).

5.5 Agitate the other half for 30 minutes at 25° C ± 2° C (77° F ± 4° F) in the sodium carbonate solution, liquor ratio 40:1. Then rinse it for 5 minutes in cold running water and dry it in air at a temperature not exceeding 60° C (140° F).

5.6 Evaluate the effect on the test-control with the Gray Scale. If the results obtained differ significantly from the following:

[to be supplied]

the test has not been carried out correctly and the operations described in 5.1 to 5.7 inclusive must be repeated with fresh composite specimens and a fresh composite test-control specimen.

5.7 Assess the change in color of each half of the specimen with the Gray Scale (See 7.1).

6. REPORT

6.1 Report the numerical rating for change in color for both the rinsed and the neutralized portions of the specimen.

7. NOTES

7.1 [To be supplied.]

7.2 See the following documents:

(a) Test No. 31.

(b) Test No. 32.

No. 40

COLORFASTNESS TO CHLORINATION, ACID

1. PURPOSE AND SCOPE

1.1 This method is intended for evaluating the resistance of the color of textiles of all kinds in all forms to the manufacturing operation in which an acid hypochlorite solution is used to prevent wool textiles from shrinking.

2. PRINCIPLE

2.1 A specimen of the textile in contact with undyed textiles of interest is treated successively with solutions of hydrochloric acid, sodium hypochlorite, and sodium sulfite, rinsed and dried. The change in color of the specimen and staining of the undyed textiles are evaluated with standard Gray Scales. A test control fabric is used.

3. APPARATUS AND REAGENTS

3.1 Yarns of scoured unbleached undyed wool, undyed bleached cotton, and other fibers as desired for evaluation of staining if fabrics or yarns are to be tested; comparable undyed fabrics if fibers are to be tested.

3.2 Hydrochloric acid solution containing 6 ml hydrochloric acid (sp gr 1.16) per liter.

3.3 Sodium hypochlorite solution containing 2 g available chlorine per liter buffered at pH 11.0 ± 0.2 with 10 g anhydrous sodium carbonate per liter, temperature 25° C ± 2° C (77° F ± 4° F).*

* It appears that this paragraph should be revised to agree with paragraph 3.1 in Method No. 36.

3.4 Sodium sulfite solution containing 3 g $Na_2SO_3 \cdot 7\ H_2O$ per liter.

3.5 Test-control dyeing, [to be inserted] (See 7.1).

3.6 Standard Gray Scales (See 7.2).

4. SPECIMEN

4.1 If the textile to be tested is cloth, sew stitches of the

undyed yarns (See 3.1) at intervals of approximately 1 cm (0.4 inch) into a specimen of the cloth at least 7.5 cm x 5 cm (3 inches x 2 inches). The combined weight of the undyed yarns should be approximately one-third of that of the cloth.

4.2 If the textile to be tested is yarn, knit it into fabric and make a composite specimen from it as in 4.1.

4.3 If the textile to be tested is fiber, comb and compress some of it into a sheet at least 7.5 cm x 5 cm (3 inches x 2 inches) in size, place the sheet between the undyed wool and undyed cotton or other fabrics, and sew the three together with stitching at intervals of 1 cm (0.4 inch). The weight of the colored textile should approximate that of the undyed wool.

4.4 Test control.—Prepare a composite specimen of the test control dyeing (3.5) in the way outlined for cloth in 4.1.

5. PROCEDURE

5.1 Carry out the operations described in sections 5.2 to 5.5 inclusive with the composite specimens and the composite test-control specimen in parallel in separate baths.

5.2 Immerse the composite specimen in the hydrochloric acid solution, liquor ratio 12.5:1 for 10 minutes at 25° C ± 2° C (77° F ± 4° F).

5.3 Add an equal volume of the sodium hypochlorite solution (3.3) and keep the composite specimen immersed for a further 10 minutes.

5.4 Rinse the composite specimen thoroughly in water and then immerse it in the sodium sulfite solution (3.4) for 10 minutes at 35° C to 40° C (95° F to 104° F).

5.5 Thoroughly rinse the composite specimen from 5.4 in water and dry it in air at a temperature not exceeding 60° C (140° F).

5.6 [Interpretation of results with the test-control specimen to be inserted.]

5.7 Evaluate the change in color of the specimen and the staining of the undyed materials with the Gray Scales (See 7.2).

6. REPORT

6.1 Report the numerical rating for change in color and the numerical rating for staining of each kind of undyed fiber tested.

7. NOTES

7.1 [Information about the test-control dyeing to be provided.]

7.2 See the following documents:

(a) Test No. 31.
(b) Test No. 32.
(c) Test No. 33.

No. 41

COLORFASTNESS TO LIGHT: DAYLIGHT

1. PURPOSE AND SCOPE

1.1 This method is intended for evaluating the resistance of the color of textiles of all kinds and in all forms to the action of daylight (See 7.1).

1.2 The method may be used for evaluating dyestuffs by applying the dyestuff to textiles under specified conditions and depth of shade and testing the dyed textiles.

2. PRINCIPLE

2.1 A specimen of the textile is exposed to daylight under prescribed conditions, including protection from rain, along with eight dyed wool standards. The fastness is evaluated by comparing the fading of the textile with that of the standards.

3. STANDARDS AND EQUIPMENT

3.1 Standards:

3.1.1 The standards for this test are blue dyed wool cloths made with the dyestuffs listed below. They range from No. 1, very low lightfastness, to No. 8, very high lightfastness (See 7.2).

Fastness Rating	*Dyestuff*
1	Acilan Brilliant Blue FFR (Bayer)
2	Acilan Brilliant Blue FFB (Bayer)
3	Supranolcyanin 6B (Bayer) or Brilliantcyanin 6B (Ciba)
4	Polar Blue G Conc (Geigy)
5	Solway Blue RS (ICI) or Acilan Fast Blue RX (Bayer) or Alizarine Light Blue R (Sandoz)
6	Acid Alizarine Sapphire 2JL (CFMC) or Alizarine Light Blue 4GL (Sandoz)
7	Soledon Blue 4BC Powder (ICI)
8	Indigosol Blue AGG (Durant) or Anthrasol Blue AGG (Hoechst)

3.1.2 Master sets of the standard dyeings are to be filed in each country for reference.

3.2 *Exposure rack,* facing due south in the Northern Hemisphere, north in the Southern Hemisphere and sloping at an angle of 45°, in a location such that shadows of surrounding objects will not fall on the exposed textiles, covered with window glass to protect the specimens from the weather, and provided with adequate ventilation.

3.3 Opaque cardboard or other thin opaque material, for example, thin sheet aluminum, or cardboard covered with aluminum foil.

3.4 Gray Scale for evaluating change in color (See 7.3).

4. SPECIMEN

4.1 An area of the textile not less than 1 cm x 6 cm (⅜ inch x 2⅜ inches) is used when the several periods of exposure are made side by side on the same piece, which is the preferred practice. The specimen may be: A strip of cloth, yarns wound close together on a card or laid parallel and fastened on a card, or mat of fibers combed and compressed to give a uniform surface and fastened on a card.

4.2 To facilitate handling the specimen or specimens to be tested and similar strips of the standards may be mounted on a card in some such arrangement as indicated in 7.5.

5. PROCEDURE

5.1 Expose the specimen, or a group of specimens, and the standards simultaneously to daylight under the conditions enumerated in 3.2 in such a manner and for such times as are necessary to fully evaluate the lightfastness of each specimen relative to that of the standards. (See 7.5 for two suggested methods of procedure.)

5.2 *Preliminary evaluation of lightfastness.* When a change in color (7.6) of the specimen under test can just be perceived, note the number of the standard showing a similar change or, alternatively, when a change in color of standard 3 can just be perceived, evaluate any change that has occurred in the specimen in comparison with the changes in standards 1, 2, and 3 (See 7.4). Continue to expose after the preliminary evaluation as required to fully evaluate lightfastness.

5.3 *Evaluation of lightfastness.* Compare the changes in color of the test specimen with the changes which have occurred in the standards (7.6). The lightfastness of the specimen is the number of the standard which shows similar changes in color (visual contrast between exposed and unexposed parts in the test). If the specimen shows changes in color intermediate between two standards, an appropriate half-rating may be given, e g lightfastness 3½ means the textile is not as fast as standard 4, but faster than standard 3.

5.4 If the color of the specimen is more than that of standard No. 1, a rating of 1 is given.

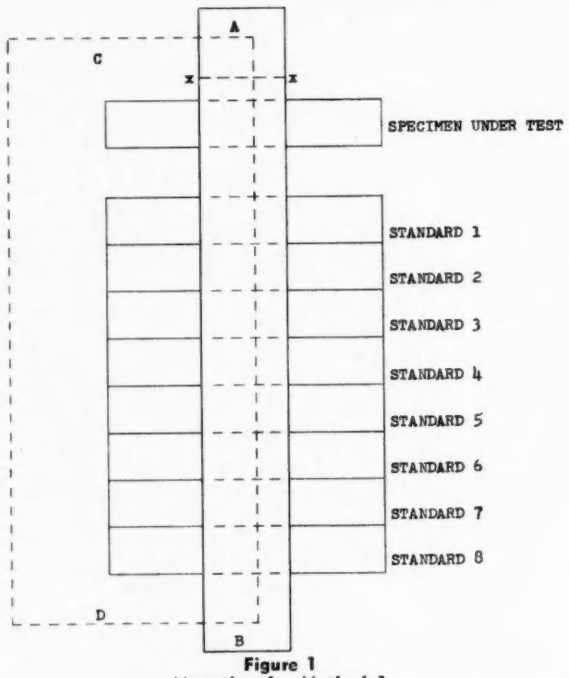


Figure 1
Mounting for Method 1

AB—Opaque cover. May be hinged at xx so that it can be lifted and returned to the same place over the specimen and standards.
CD—Second cover.

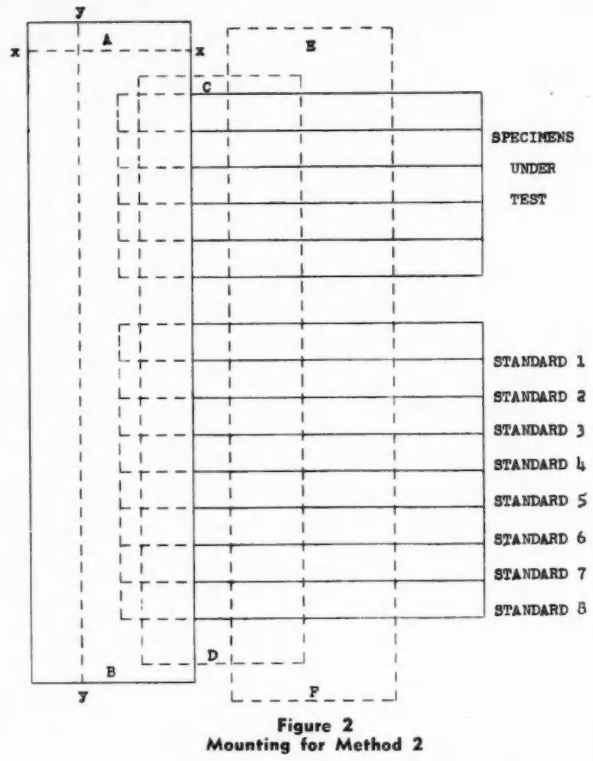


Figure 2
Mounting for Method 2

5.5 If the lightfastness is 4 or higher, the evaluation based on the first perceptible change (5.2) becomes significant and if this preliminary evaluation is 3 or lower, it is to be included in the rating in brackets. For example, a rating of 6 [3] indicates that the specimen changed very slightly in the test when standard 3 just began to fade, but that on continuing the exposure the resistance to light was equal or better than* that of standard 6.

* The words "or better than" will probably be deleted and "to" inserted in the next draft.

6. REPORT

6.1 Report the numerical rating for lightfastness and if the preliminary evaluation was 3 or lower report this figure in brackets.

7. NOTES

7.1 The use of fading lamps rather than daylight is common practice and the results obtained with such tests are undoubtedly useful where speed is essential. The results obtained for many textiles differ, however, from the results obtained with daylight exposure.

7.2 Sets of the lightfastness standards can be obtained presently from the British Standards Institution, British Standards House, 2 Park St, London W1, England.
They are specially dyed to match a Master set of standards in color and in fading behavior. It has been found when repeated dyeings of the dyed standards are made that the amount of dyestuff required to match the previous lot is often different from that originally used. The dyeing strengths would, therefore, be misleading and they are intentionally omitted from this listing.

7.3 Colorfastness of Textiles: General Principles of Testing, ISO/TC 38/SC 1 (USA Secretariat 14) 31, and Colorfastness: Gray Scale for Evaluating Change in Color, ISO/TC 38/SC 1 (USA Secretariat 15) 32.

7.4. Phototropic specimens must be allowed to condition in the dark at room temperature for 2 hours before assessing the change in color.

7.5 Suggested procedures for mounting and testing for lightfastness:

7.5.1 *Method 1.*

7.5.1.1 This method is considered ideal and should be used in cases of dispute. It requires one set of standards for each specimen under test and is therefore impracticable when a large number of specimens have to be tested concurrently; in such cases, method 2 (7.5.2) is suggested.

7.5.1.2 Arrange the specimen to be tested and the standards as shown in Figure 1 with an opaque cover across the middle third of the specimen and standards. Expose to daylight under the conditions enumerated in 3.2. Follow the effect of light by removing the cover and inspecting the specimen frequently. When a change can just be perceived, note the number of the standard showing a similar change.

7.5.1.3 Continue to expose until the contrast between the exposed and covered portion of the specimen is equal to the contrast between the two gray color chips illustrating Grade 3 on the Gray Scale (7.3). Cover a second one-third of the specimen and standards with an additional opaque cover, CD in Figure 1.

7.5.1.4 Continue to expose until the contrast between the fully exposed and the unexposed portion is equal to Grade 2 on the Gray Scale. If standard 7 fades to a contrast equal to Grade 3 on the Gray Scale before the specimen does, the exposure may be concluded at this stage. (When a specimen has a lightfastness of 7 or over, it would require unduly long exposure to produce a contrast equal to Grade 2; moreover this contrast would be impossible to obtain when the light-

fastness is 8. Evaluations in the region 7 to 8 are, therefore, made when the contrast produced on standard 7 is equal to Grade 3, the time required to produce this contrast being long enough to eliminate any error which might result from inadequate exposure.)

7.5.1.5 Evaluation of lightfastness. The specimen now shows three separate areas—an unexposed region and two areas which have been changed to different degrees. Compare these changes with the changes which have occurred in the standards and rate lightfastness as in 5.3.

7.5.2 *Method 2.*

7.5.2.1 This method should be used when a large number of specimens have to be tested concurrently. It enables a number of specimens differing in lightfastness to be rated against a single set of standards.

7.5.2.2 Arrange the specimens to be tested and the standards as shown in Figure 2, with card AB covering one-quarter of the total length of each specimen and standard. Expose to daylight under the conditions enumerated in 3.2. Follow the effect of light by lifting the cover periodically and inspecting the *standards*. When a change in standard 3 can just be perceived, inspect the specimens and rate their lightfastness by comparing any change that has occurred with the changes that have occurred in standards 1, 2, and 3.

7.5.2.3 Replace the card in exactly the same position and continue to expose until a change in standard 4 can just be perceived; at this point fix an additional cover, CD, in the position shown in Figure 2, overlapping the first cover.

7.5.2.4 Continue to expose until a change in standard 6 can just be perceived; then fix the final cover, EF, in the position shown, the other two covers remaining in position. Expose until either: (a) a contrast is produced on standard 7 equal to the contrast illustrating Grade 3 of the Gray Scale, or (b) a contrast equal to Grade 2 has been produced on the most resistant specimen, whichever occurs first. Remove the three covers.

7.5.2.5 Compare the changes in the specimens with those in the standards and rate lightfastness as in 5.3.

7.6 The term "change in color" includes not only true "fading," i e, destruction of dyestuff, but also changes in hue, depth, brightness, or any combination of these characteristics of color.

No. 42

COLORFASTNESS TO MERCERIZING

1. PURPOSE AND SCOPE

1.1 This method is intended for evaluating the resistance of the color of cotton yarns and mixed fiber yarns containing other natural cellulosic fibers with cotton to the action of concentrated solutions of sodium hydroxide used in mercerizing.

2. PRINCIPLE

2.1 A specimen of the textile in contact with specified undyed cotton cloth is treated with the sodium hydroxide solution, rinsed, acidified, rinsed and dried. The change in color of the specimen and staining of the undyed cloth are evaluated with standard Gray Scales.

3. APPARATUS AND REAGENTS

3.1 Undyed, bleached, cotton cloth at least 10 cm x 10 cm for evaluating staining.

3.2 Frame for holding specimen (See 4).

3.3 Sodium hydroxide solution, 300 g sodium hydroxide per liter.

3.4 Sulfuric acid solution, 5 ml concentrated sulfuric acid (sp gr 1.84) per liter.

3.5 Standard Gray Scales (See 7.1).

4. SPECIMEN

4.1 If the textile to be tested is cloth, sew a specimen of it at least 10 cm x 10 cm to an equal sized piece of the undyed cloth, 3.1, along all four sides. Fasten this composite specimen firmly, but without excessive tension, to a frame with the colored material uppermost.

4.2 If the textile to be tested is yarn or thread wind it firmly, but without excessive tension, on a rigid frame with the strands close together and parallel to provide an area at least 10 cm x 10 cm. Sew an equal sized piece of the undyed cloth to this area along the two sides across the strands, with the colored material uppermost.

5. PROCEDURE

5.1 Immerse the composite specimen in the sodium hydroxide solution at 20° C ± 2° C (68° F ± 4° F) for 5 minutes. Rinse it in water at 70° C ± 2° C (158° F ± 4° F) for 5 minutes and in cold running water for 5 minutes.

5.2 Remove it from the frame and immerse it in the sulfuric acid solution for 5 minutes to acidify it. Wash it in cold running water until neutral.

5.3 Remove the stitching along three sides (one side for yarns and threads) and dry in air at a temperature not exceeding 60° C (140° F) taking care that the undyed cloth and colored material are kept apart except at the stitching.

5.4 Evaluate the change in color of the specimen and the staining of the undyed cotton cloth with the Gray Scales (See 7.1).

6. REPORT

6.1 Report the numerical rating for change in color and the numerical rating for staining of undyed cotton cloth.

7. NOTE

7.1 See the following documents:

(a) Test No. 31.
(b) Test No. 32.
(b) Test No. 33.

No. 43

COLORFASTNESS TO METALS IN THE DYEBATH: CHROMIUM SALTS

1. PURPOSE AND SCOPE

This method is intended for evaluating the effect on the shade of a dyestuff when dyed in the presence of hexavalent chromium salts.

2. PRINCIPLE

The difference in shade between dyeings made with and without potassium dichromate is evaluated with the standard Gray Scale.

3. APPARATUS AND REAGENTS

3.1 Two pieces of undyed light wool serge of a size suitable for laboratory dyeing.

3.2 Two dye baths and solutions normal for the dyestuff.

3.3 Potassium dichromate solution containing 1% $K_2Cr_2O_7$ on the weight of one piece of the wool (3.1).

3.4 Gray Scale for evaluating change in color (See 7.1).

4. SPECIMEN (See 3.1)

5. PROCEDURE

5.1 Make two dyeings of the dye at the standard depth of shade on the wool using the normal method for the dyestuff

under examination and a liquor ratio of 40:1.

5.2 On completion of the dyeing add to one of the dyebaths sufficient potassium dichromate solution to give 1% $K_2Cr_2O_7$ on the weight of the wool. Maintain the bath at the boil for a further 60 minutes.

5.3 Compare the shade of the dyeing in the presence of potassium dichromate with that of the dyeing without and evaluate the difference with the Gray Scale.

6. REPORT

Report the dyestuff used, the method and strength of dyeing, and the numerical ratios of the change in shade.

7. NOTES

7.1 See the following documents:

(a) Test No. 31.

(b) Test No. 32.

No. 44

COLORFASTNESS TO METALS IN THE DYEBATH: IRON AND COPPER

1. PURPOSE AND SCOPE

This method is intended for evaluating the effect on the shade of a dyestuff when dyed in the presence of metals used in the construction of dyeing machinery.

2. PRINCIPLE

The difference in shade between dyeings made in the presence and absence of salts of the metal is evaluated with the standard Gray Scale.

3. APPARATUS AND REAGENTS

3.1 Three pieces of undyed light wool serge of a size suitable for laboratory dyeing.

3.2 Three dye baths and solutions normal for the dyestuff.

3.3 Copper sulfate solution containing 0.2% $CuSO_4 \cdot 5H_2O$ on the weight of one piece of the wool (3.1).

3.4 Ferric ammonium sulfate solution containing 0.5% $Fe_2(SO_4)_3 \cdot (NH_4)_2\ SO_4 \cdot 24H_2O$ on the weight of one piece of the wool (3.1).

3.5 Gray Scale for evaluating change in color (See 7.1).

4. SPECIMEN (See 3.1)

5. PROCEDURE

5.1 Make three dyeings at the standard depth of shade on the wool serge according to the normal method for the dyestuff under examination. Before entering the fabric, add the ferric ammonium sulfate to one dyebath and the copper sulfate to another and bring the liquor ratio in each bath to 40:1.

5.2 Compare the shades of the dyeings made in the presence of copper sulfate and ferric sulfate with that of the dyeing made without and evaluate the differences with the Gray Scale.

6. REPORT

Report the dyestuff used, and method and strength of dyeing, and the numerical rating of the change in shade.

7. NOTES

7.1 See the following documents:

(a) Test No. 31.

(b) Test No. 32.

No. 45

COLORFASTNESS TO ORGANIC SOLVENTS

1. PURPOSE AND SCOPE

1.1 This method is intended for evaluating the resistance of the color of textiles of all kinds in all forms to organic solvents, and in particular to solvents used in cleaning or mill processing.

2. PRINCIPLE

2.1 A specimen of the textile in contact with specified undyed cloths is agitated in the solvent. The change in color of the specimen and staining of the undyed cloths are evaluated with standard Gray Scales.

3. APPARATUS AND REAGENTS

3.1 Suitable container with means of agitation (See 7.1).

3.2 Specified solvent (See 7.2).

3.3 Two undyed cloths, each 10 cm x 4 cm, one piece made of the same kind of fiber as that in the textile to be tested, the second piece made of the fiber indicated below, or as otherwise specified (See 7.3).

if first piece is:	*second piece to be:*
cotton	wool
wool	cotton
silk	cotton
linen	wool
viscose	wool
acetate	viscose
polyamide	wool

3.4 Gray Scales for evaluating change in color and staining of undyed cloths (See 7.4).

4. SPECIMEN

4.1 If the textile to be tested is cloth, place a 10 cm x 4 cm specimen of it between the two pieces of white cloth required in 3.3, and sew along all four sides to form a composite specimen.

4.2 If the textile to be tested is yarn, knit it into cloth and treat it as in 4.1, or form a layer of parallel lengths of it between the two undyed cloths and sew around the four sides to hold the yarns in place.

4.3 If the textile to be tested is bulk fiber, comb and compress enough of it to form a sheet 10 cm x 4 cm, place it between the two undyed cloths, and sew around the four sides to hold the fibers in place.

5. PROCEDURE

5.1 Agitate the composite specimen continuously for 30 minutes in the solvent at 25° C ± 2° C (77° F ± 4° F) with a liquor ratio of 40:1. If the agitation is by hand, the specimen must be pressed against the container every two minutes with the stirring rod without removing the specimen from the solvent.

5.2 Squeeze excess solvent from the specimen and dry it in air at 80° C ± 2° C (176° F ± 4° F) without unstitching. Take the precautions necessary for safety in drying flammable or explosive solvents.

5.3 Remove the stitching and evaluate the change in color of the specimen and the staining of the undyed cloths with the Gray Scale (See 3.4).

6. REPORT

Report the solvent used, the numerical rating for color change, and the numerical rating for staining of each kind of white fiber tested.

7. NOTE

7.1 A 600 ml beaker or other suitable open container may

be used for the test, agitating by hand with a glass rod flattened at one end. A closed vessel agitated by shaking or tumbling in a hand or motor driven machine may be used.

7.2 It is anticipated that the test will be made in European countries with trichlorethylene and in the United States with perchlorethylene and with Stoddard Solvent (specially specified naphtha for use of dry cleaners). Other solvents for which information is desired may be used. Trichlorethylene should be used for rating dyestuffs. Halogenated hydrocarbons should be stored over anhydrous sodium carbonate to neutralize hydrochloric acid.

7.3 The undyed cloths should be plain weave, medium weight, and free from finishes, residual chemicals, and chemically damaged fibers. Cotton and linen should be bleached, other materials should be cleaned to their usual degree of whiteness without bleaching. It is suggested that the kinds of fibers listed in 3.3 be rated regularly. Others may be rated in addition.

7.4 See the following documents:

(a) Test No. 31.
(b) Test No. 32.
(c) Test No. 33.

No. 46

COLORFASTNESS TO POTTING

1. PURPOSE AND SCOPE

This method is intended for evaluating the resistance of the color of wool and part wool textiles to the action of boiling water.

2. PRINCIPLE

A specimen of the textile between undyed wool and cotton cloths is rolled around a glass rod and treated with boiling water. The cloths are separated and dried, and the change in color of the specimen and staining of the undyed cloths are assessed with standard Gray Scales.

3. APPARATUS AND REAGENTS

3.1 Vessel equipped with reflux to hold cylindrical specimen 4 cm long in boiling water.

3.2 Glass rod 5 to 8 mm in diameter.

3.3 Undyed, unbleached wool serge 10 cm x 4 cm.

3.4 Undyed, bleached cotton limitric or the fiber used in mixture with the wool.

3.5 Gray Scales for evaluating change in color and staining of undyed cloths (See 7.1).

4. SPECIMEN

4.1 If the textile to be tested is cloth, place a 10 cm x 4 cm specimen of it between the two pieces of undyed cloth required in 3.3 and 3.4 and sew along one of the shorter sides.

4.2 If the textile to be tested is yarn, knit it into cloth and treat it as in 4.1, or form a layer of parallel lengths of it between the two undyed cloths and sew around the four sides to hold the yarns in place.

4.3 If the textile to be tested is bulk fiber, comb and compress enough of it to form a sheet 10 cm x 4 cm, place it between the two undyed cloths, and sew around the four sides to hold the fibers in place.

5. PROCEDURE

5.1 Roll the composite specimen around the glass rod to form a cylinder 4 cm long and tie it loosely with thread.

5.2 Treat the specimen on the rod for 1 hour in boiling distilled water, liquor ratio 30 to 1, under reflux.

5.3 Remove the specimen from the rod and separate the undyed cloths from it. Dry all three in air at a temperature not exceeding 60° C (140° F).

5.4 Evaluate the change in color of the specimen and the staining of the undyed cloths with the Gray Scales (See 7.1).

6. REPORT

Report the numerical rating for change in color and the numerical rating for staining of each kind of undyed fiber tested.

7. NOTES

7.1 See the following documents:

(a) Test No. 31.
(b) Test No. 32.
(c) Test No. 33.

No. 47

COLORFASTNESS TO PRESSING: HOT PRESSING

1. PURPOSE AND SCOPE

1.1 This method is intended for evaluating the resistance of the color of textile yarns, thread, and fabrics of all kinds to ironing and to processing on hot cylinders.

1.2 Tests are given for hot pressing when the textile is wet and when it is dry.

2. PRINCIPLE

2.1 For dry pressing, the dry specimen on a dry undyed cotton cloth is pressed with an iron of specified weight and temperature. For wet pressing, the wet specimen placed on a dry white cotton cloth and covered with a wet undyed cotton cloth is pressed with the iron. The change in color and staining of the undyed cloths are evaluated with standard Gray Scales immediately and after a period of exposure to air.

3. APPARATUS AND REAGENTS

3.1 Hand iron of the proper weight to give a pressure of approximately 30 g/cm² (See 7.1) at the temperature indicated in the following table (See 7.2).

Fabric	*Temperature*
Cotton and linen	190°C to 210°C (374°F to 410°F)
Wool, silk, and rayon	140°C to 160°C (284°F to 320°F)
Acetate and polyamide	115°C to 120°C (239°F to 248°F)

3.2 Undyed, bleached, cotton cloth weighing approximately 125 g/m² (3.7 oz/yd²). Three pieces not less than 14 cm x 4 cm are required.

3.3 Gray Scales for evaluating change in color and staining (See 7.3).

4. SPECIMEN

4.1 If the textile to be tested is cloth, a piece 10 cm x 4 cm is required.

4.2 If the textile to be tested is yarn or thread, knit it into cloth and use a piece 10 cm x 4 cm or wind it around a piece of thin cardboard 14 cm x 4 cm to obtain the area of the textile for test.

5. PROCEDURE

5.1 Specimens of materials that have been subjected to any heat or drying treatment must be allowed to condition (by exposure to air at 65% relative humidity and 20° C ± 2° C) before they are tested.

5.2 *Dry pressing.*—Place the specimen on the piece of dry cotton cloth (3.2) on a smooth horizontal surface. Place the iron on top and leave it for 10 seconds.

5.3 *Wet pressing.*—Soak the specimen and a piece of the cotton cloth (3.2) in distilled water and squeeze or extract

them to contain their own weights of water. Place the wet specimen on a piece of the dry cotton cloth (3.2) and place the wet cotton cloth on the specimen. Press by moving the iron to and fro over the wet cloth (without additional pressure) for 10 seconds.

5.4 Evaluate the change in color of the specimen with the appropriate Gray Scale (See 7.3) immediately and again after the specimen has been allowed to condition for 4 hours in the standard atmosphere, i e, 65% relative humidity and 20° C ± 2° C (68° F ± 4° F).

5.5 Evaluate the staining of the undyed cloths with the appropriate Gray Scale (See 7.3).

6. REPORT

6.1 Report the numerical rating for the change in color for dry pressing and wet pressing immediately after testing and after conditioning for 4 hours. Report the numerical rating of the staining of the undyed cloth.

7. NOTES

7.1 The pressure on the cloth under test will depend upon the area of the bottom of the iron lying over the 14 cm x 4 cm specimen.

7.2 [Method of measuring temperature of the iron to be supplied.]

7.3 See the following documents:

(a) Test No. 31.
(b) Test No. 32.
(c) Test No. 33.

No. 48

COLORFASTNESS TO RUBBING

1. PURPOSE AND SCOPE

1.1 This method is intended for evaluating the resistance of the color of textile yarns, thread, and fabrics of all kinds to rubbing off and staining other materials.

1.2 Two tests are made, one with a dry rubbing cloth and one with a wet rubbing cloth.

2. PRINCIPLE

Specimens of the textile are rubbed with dry undyed cotton cloth and with wet undyed cotton cloth. The staining of the undyed cloths is evaluated with standard Gray Scale.

3. APPARATUS AND REAGENTS

3.1 Crockmeter or its equivalent (See 7.1).

3.2 Bleached undyed cotton lawn or similar cloth free from starch or other finish, cut into 5 cm (2-inch) squares (See 7.2).

3.3 Gray Scale for evaluating staining of undyed cloth (See 7.3).

4. SPECIMEN

4.1 If the textile to be tested is cloth, two pieces not less than 14 cm by 5 cm (5½ inches x 2 inches) are required for dry rubbing and two for wet rubbing. One specimen of each pair has the long direction parallel to the warp yarns, the other parallel to the filling yarns.

4.2 If the textile to be tested is yarn or thread, knit it into cloth of suitable dimensions (See 4.1) or form a layer of parallel strands by wrapping it lengthwise on a cardboard rectangle of suitable dimensions.

5. PROCEDURE

5.1 *Dry rubbing.*—With the dry undyed cloth in place over the end of the finger of the testing device, rub it to-and-fro in a straight line over a track 10 cm (4 inches) long on the dry specimen, 10 times in 10 seconds, with a downward force on the finger of 900 g (2 pounds). Test warp and filling directions separately.

5.2 *Wet rubbing.*—Repeat the test using fresh dry specimen and undyed cloth which have been wetted with water and squeezed to an add-on of 100%. Dry the cloths at room temperature.

5.3 Evaluate the staining of the undyed cloths with the Gray Scale (7.3).

6. REPORT

Report the numerical rating for dry staining and for wet staining for the direction, warp or filling, showing heavier staining.

7. NOTES

7.1 The crockmeter may be obtained from the Secretary, AATCC, Lowell Technological Institute, Lowell, Massachusetts. It is described in the 1944 AATCC Year Book, page 192. Duplex crockmeters for testing two specimens simultaneously are described in *Am Dyestuff Reptr 36,* 392 (1947).

7.2 Cloth for the the purpose may be obtained from the Secretary, AATCC, Lowell Technological Institute, Lowell, Massachusetts.

7.3 See the following documents:

(a) Test No. 31.
(b) Test No. 33.

No. 49

COLORFASTNESS TO SODA BOILING

1. PURPOSE AND SCOPE

1.1 This method is intended for evaluating the resistance of the color of natural and regenerated cellulose textiles in all forms to the action of boiling dilute sodium carbonate solutions.

1.2 Two tests are given, one with and the other without the addition of a reduction inhibitor.

2. PRINCIPLE

2.1 A specimen of the textile between specified undyed cloths is rolled around a glass rod and treated with boiling sodium carbonate solution with and without a reduction inhibitor. The composite specimen is rinsed, the cloths separated, dried, and the change in color of specimen and staining of the undyed cloths are evaluated with standard Gray Scales.

3. APPARATUS AND REAGENTS

3.1 Vessel equipped with water-cooled reflux condenser to hold cylindrical specimen 4 cm long in boiling solution.

3.2 Glass rod 5 to 8 mm in diameter.

3.3 Desized undyed cotton fabric.

3.4 Undyed cloth of the type under test (or, if fiber or yarn is being tested, undyed cloth made from the same kind of fiber).

3.5 Sodium carbonate solution containing 10 g anhydrous sodium carbonate per liter.

3.6 Sodium carbonate solution containing 10 g anhydrous sodium carbonate per liter and 4 g sodium m-nitrobenzene sulfonate per liter.

3.7 Gray Scales for evaluating changes in color and staining of undyed cloths (See 7.1).

4. SPECIMEN

4.1 Two specimens prepared as follows, are required.

4.2 If the textile to be tested is cloth, place a 10 cm by 4 cm specimen of it between pieces of the undyed cloth specified in 3.3 and 3.4 and sew along one of the shorter sides

4.3 If the textile to be tested is yarn, knit it into cloth and treat it as in 4.2, or form a layer of parallel lengths of it between the two undyed cloths and sew around the four sides to hold the yarns in place.

4.4 If the textile to be tested is bulk fiber, comb and compress enough of it to form a sheet 10 cm x 4 cm, place it between the two undyed cloths, and sew around the four sides to hold the fibers in place.

5. PROCEDURE

5.1 Roll the composite specimen around the glass rod to form a cylinder 4 cm long and tie it loosely with thread.

5.2 Treat one composite specimen on the rod for 1 hour in the boiling sodium carbonate solution, 3.5, liquor ratio 30:1, under reflux. Treat the other composite specimen in the same way and for the same time in boiling sodium carbonate solution containing the sodium m-nitrobenzene sulfonate, 3.6.

5.3 Remove the specimens from the rod, rinse for 10 minutes in cold running water, and separate the undyed cloths from them. Dry all pieces in air at a temperature not exceeding 60° C (140° F).

5.4 Evaluate the changes in color of the specimens and the staining of the undyed cloths with the Gray Scales (See 7.1).

6. REPORT

Report the numerical ratings for change in color and the numerical ratings for staining of each kind of undyed cloth tested with sodium carbonate alone and with sodium carbonate and sodium m-nitrobenzene sulfonate reduction inhibitor.

7. NOTES

7.1 See the following documents:

(a) Test No. 31.
(b) Test No. 32.
(c) Test No. 33.

No. 50

COLORFASTNESS TO STOVING

1. PURPOSE AND SCOPE

This method is intended for evaluating the resistance of the color of wool, silk, and mixed-fiber textiles containing one of these fibers, to the action of sulfur dioxide as used for bleaching animal fibers.

2. PRINCIPLE

A specimen of the textile containing its own weight of soap solution and a control are exposed in an atmosphere containing sulfur dioxide. The change in color of the specimen is evaluated with a standard Gray Scale.

3. APPARATUS AND REAGENTS

3.1 Vessel of approximately 10 liters capacity for the sulfur dioxide atmosphere.

3.2 Sulfur.

3.3 Soap, containing not more than 5% moisture and complying with the following requirements based upon dry weight:

Free alkali calculated as Na_2CO_3	:	0.3% maximum
Free alkali calculated as NaOH	:	0.2% maximum, USA; 0.0%, SDC
Free fatty acid	:	0.1% maximum, USA; not to exceed 1%, SDC
Combined fatty acids calculated as Na salt	:	85% minimum
Titre of mixed fatty acids prepared from the soap	:	39° C minimum
Iodine number of mixed fatty acids	:	to be supplied if desired
Acid number of mixed fatty acids	:	to be supplied if desired
pH of a 0.5% solution	:	9.5 to 10.5

3.4 Soap solution, containing 5 g of soap (See 3.3) per liter of distilled water.

3.5 Control [To be supplied].

3.6 Gray Scale for evaluating change in color (See 7.1).

4. SPECIMEN

4.1 If the textile to be tested is cloth, a piece at least 10 cm x 4 cm is required.

4.2 If the textile to be tested is yarn, knit it into cloth and use a piece at least 10 cm x 4 cm or from a number of lengths of it form a wick 10 cm long and 0.5 cm in diameter tied at both ends.

4.3 If the textile to be tested is bulk fiber, comb and compress enough of it to form a sheet at least 10 cm by 4 cm.

5. PROCEDURE

5.1 Thoroughly impregnate the specimen and the test-control specimen by immersion for 5 minutes at 25° C ± 2° C (77° F ± 4° F) in the soap solution. Then squeeze so that each contains its own weight of solution.

5.2 Suspend the specimen and the test-control (3.5) for 16 hours in the vessel containing an atmosphere of sulfur dioxide obtained by igniting 5 g of sulfur below the specimen and control and immediately closing the vessel.

5.3 Remove the specimen and control from the sulfur dioxide atmosphere and allow to hang in air for at least 2 hours without rinsing. The specimen and control are to be examined when dry. If the specimen contains cellulosic fibers rinse it in cold running water and dry in air at a temperature not exceeding 60° C (140° F).

5.4 [Instructions for the control to be provided.]

5.5 Evaluate the change in color of the specimen with the Gray Scale (See 7.1).

6. REPORT

6.1 Report the numerical rating for the color change in the test.

7. NOTES

7.1 See the following documents:

(a) Test No. 31.
(b) Test No. 32.

No. 51

COLORFASTNESS TO WASHING: HANDWASHING

1. PURPOSE AND SCOPE

This method is intended for evaluating the resistance of the color of textiles of all kinds in all forms to the action of soap solutions as used in washing them by hand.

2. PRINCIPLE

A specimen of the textile in contact with specified undyed cloths is agitated in a soap solution, rinsed, and dried. The change in color of the specimen and staining of the undyed cloths are evaluated with standard Gray Scales.

3. APPARATUS AND REAGENTS

3.1 Suitable container with means of agitation (See 7.1

3.2 Soap, containing not more than 5% moisture and complying with the following requirements based upon dry weight:

Free alkali calculated as Na_2CO_3	:	0.3% maximum
Free alkali calculated as NaOH	:	0.2% maximum, USA; 0.0%, SDC
Free fatty acid	:	0.1% maximum, USA; not to exceed 1%, SDC
Combined fatty acids calculated as Na salt	:	85% minimum
Titre of mixed fatty acids prepared from the soap	:	39° C minimum
Iodine number of mixed fatty acids	:	to be supplied if desired
Acid number of mixed fatty acids	:	to be supplied if desired
pH of a 0.5% solution	:	9.5 to 10.5

3.3 Soap solution, containing 5 g of soap (See 3.2) per liter of distilled water.

3.4 Two undyed cloths, each 10 cm x 4 cm, one piece made of the same kind of fiber as that in the textile to be tested, the second piece made of the fiber indicated below, or as otherwise specified.

if first piece is:	*second piece to be:*
cotton	wool
wool	cotton
silk	cotton
linen	wool
viscose	wool
acetate	viscose
polyamide	wool

3.5 Gray Scales for evaluating change in color and staining of undyed cloths (See 7.2).

4. SPECIMEN

4.1 If the textile to be tested is cloth, place a 10 cm x 4 cm specimen of it between the two pieces of undyed cloth required in 3.4, and sew along all four sides to form a composite specimen.

4.2 If the textile to be tested is yarn, knit it into cloth and treat it as in 4.1, or form a layer of parallel lengths of it between the two undyed cloths and sew around the four sides to hold the yarns in place.

4.3 If the textile to be tested is bulk fiber, comb and compress enough of it to form a sheet 10 cm x 4 cm, place it between the two undyed cloths, and sew around the four sides to hold the fibers in place.

5. PROCEDURE

5.1 Agitate the composite specimen continuously for 30 minutes in the soap solution at 40° C ± 2° C (104° F ± 4° F) with a liquor ratio of 50:1. If the agitation is by hand, press the specimen against the container 10 times every three minutes without removing it from the solution. If mechanical agitation is used (See 7.1) the time of treatment and if necessary liquor ratio shall be adjusted so as to give results identical with those of the hand test.

5.2 Rinse the composite specimen twice in distilled water and then for 10 minutes in cold running water. Squeeze it, remove the stitching along three sides, and dry in air at a temperature not over 60° C (140° F), with the three parts in contact only along the one row of stitching.

5.3 Evaluate the change in color of the specimen and the staining of the undyed cloths with the Gray Scales (See 7.2).

6. REPORT

6.1 Report the numerical ratings for color change and for staining of each kind of undyed fiber tested.

7. NOTES

7.1 A 500 ml beaker or other suitable open container may be used for the test, agitating by hand with a glass rod flattened at one end. A closed vessel agitated by shaking or tumbling it by hand, or a motor driven machine may be used.

7.2 See the following documents:

(a) Test No. 31.
(b) Test No. 32.
(c) Test No. 33.

No. 52

COLORFASTNESS TO WATER, FLAT DISH METHOD

1. PURPOSE AND SCOPE

1.1 This method is intended for evaluating the resistance of the color of textiles of all kinds in all forms to immersion in water.

2. PRINCIPLE

2.1 A specimen of the textile in contact with specified undyed cloths is covered with water in a flat dish and then with a glass plate. The water is poured off and the wet cloths allowed to lie under the glass. The specimen and undyed cloths are dried separately. The change in color of the specimen and staining of the undyed cloths are evaluated with standard Gray Scales.

3. APPARATUS AND REAGENTS

3.1 Flat-bottomed dish, area of bottom greater than 5 cm x 5 cm.

3.2 Smooth glass plate 5 cm x 5 cm, or slightly larger weighing approximately 50 g.

3.3 Two undyed cloths, each 5 cm x 5 cm. One piece made of the same kind of fiber as that in the textile to be tested, the second piece made of the fiber indicated below, or as otherwise specified (See 7.1).

if first piece is:	*second piece to be:*
cotton	wool
wool	cotton
silk	cotton
linen	wool
viscose	wool
acetate	viscose
polyamide	wool

3.4 Standard Gray Scales (See 7.2).

3.5 Oven maintained at 37° C ± 2° C (100° F ± 4° F).

4. SPECIMEN

4.1 If the textile to be tested is cloth, place a 5 cm x 5 cm specimen of it between the two pieces of the white cloth, 3.3, and sew along one side to form a composite specimen.

4.2 If the textile to be tested is yarn, knit it into cloth and treat it as in 4.1, or form a layer of parallel lengths of it between the two undyed cloths and sew along two opposite sides near the ends of the yarns to form a composite specimen.

4.3 If the textile to be tested is fiber, comb and compress some of it into a sheet 5 cm x 5 cm in size, place the sheet between the two undyed cloths, and sew along two opposite sides to form a composite specimen.

5. PROCEDURE

5.1 Thoroughly wet the composite specimen in distilled water at 25° C ± 2° C (77° F ± 4° F). Lay it out smooth in the flat-bottomed dish and cover it with distilled water. Place the glass plate on it and press evenly and lightly with three fingers to remove air bubbles. Allow to stand for 15 minutes at 25° C ± 2° C (77° F ± 4° F).

5.2 Pour off the water without removing the glass plate. Allow the specimen to remain under the plate for 4 hours at 37° C ± 2° C (98° F ± 4° F).

5.3 Separate the specimen and white cloths and dry them

apart in air at a temperature not exceeding 60° C (140° F).

5.4 Evaluate the change in color of the specimen and the staining of the undyed cloths with the Gray Scales (See 7.2).

6. REPORT

Report the numerical rating for color change and the numerical rating for staining of each kind of undyed fiber tested.

7. NOTES

7.1 See the first reference in 7.2, below, especially section 7.8 in it.

7.2 See the following documents:

(a) Test No. 31.
(b) Test No. 32.
(c) Test No. 33.

No. 53

COLORFASTNESS TO WATER, TEST TUBE METHOD

This method is similar to No. 52 except that the composite specimen is rolled into a cylinder and treated in a test tube of suitable dimensions to take the roll easily instead of in the flat dish, liquor ratio 6:1, and the water is not poured off.

No. 54

COLORFASTNESS TO WATER, PERSPIROMETER METHOD*

* The "Perspirometer" developed by the American Association of Textile Chemists and Colorists is intended for carrying out tests of this kind. For information about it write to The Secretary, AATCC, Lowell Technological Institute, Lowell, Massachusetts.

This method is similar to No. 52 except that the specimens and undyed cloths are about 6.5 cm (2½ inches) square, and after immersion in water at room temperature for 15 minutes and pouring off the water, the composite specimen is placed between two glass plates measuring about 7.5 x 6.5 cm (3 x 2½ inches) under a force of about 4.5 kg (10 lb) for the 4 hours at 37° C ± 2° C (100° F ± 4° F).

No. 55

COLORFASTNESS TO SEA WATER, FLAT DISH METHOD

This method is similar to No. 52 except that distilled water containing 30 g of sodium chloride per liter is used instead of distilled water.

No. 56

COLORFASTNESS TO SEA WATER, TEST TUBE METHOD

This method is similar to No. 53 except that distilled water containing 30 g of sodium chloride per liter is used instead of distilled water, the liquor ratio is 6.1, and the liquor is not poured off.

No. 57

COLORFASTNESS TO SEA WATER, PERSPIROMETER METHOD

This method is similar to No. 54 except that distilled water containing 30 g of sodium chloride per liter is used instead of distilled water.

No. 58

COLORFASTNESS TO WATER SPOTTING

1. PURPOSE AND SCOPE

This method is intended for evaluating the resistance of the color of textiles of all kinds in all forms to spotting by water.

2. PRINCIPLE

A droplet of distilled water is worked into the textile with a glass rod and the change in color of the textile is evaluated with a standard Gray Scale after two minutes and after drying.

3. APPARATUS AND REAGENTS

3.1 Pipette or dropper to deliver approximately 0.15 ml of water.

3.2 Glass rod with rounded end.

3.3 Gray Scale for evaluating change in color (See 7.1).

4. SPECIMEN

4.1 If the textile to be tested is cloth, a piece at least 10 cm x 4 cm is required.

4.2 If the textile to be tested is yarn, knit it into cloth and use a piece at least 10 cm x 4 cm or form a wick from a number of lengths of it, about 10 cm long and 0.5 cm in diameter, tied at both ends.

4.3 If the textile to be tested is fiber, comb and compress some of it into a sheet at least 10 cm x 4 cm in size.

5. PROCEDURE

5.1 Spot the specimen with approximately 0.15 ml of distilled water at 25° C ± 2° C (78° F ± 4° F). Work the droplet into the specimen with the glass rod.

5.2 After 2 minutes evaluate the change in color in the periphery of the spot with the Gray Scale.

5.3 Dry the specimen in air at 25° C ± 2° C (78° F ± 4° F) and evaluate the change in color in the periphery of the spot with the Gray Scale.

6. REPORT

Report the numerical rating for change in color after 2 minutes and after drying.

7. NOTES

7.1 See the following documents:

(a) Test No. 31.
(b) Test No. 32.

Report of New York Section Meeting

November 20, 1953
Rochelle Park, N J

A MEETING of the New York Section was held on Friday evening, November 20th, 1953 at Kohler's Swiss Chalet, Rochelle Park, New Jersey. An informal dinner preceded the meeting.

The Chairman, Weldon G Helmus, presented the National President, J Robert Bonnar. He called attention to the fact that copies of the Vat Monograph were available from the National Secretary's office and stated that copies would be available for examination at the next meeting of the Section.

Henry L Young, Chairman of the Nominating Committee, presented the following as the committee's choices for election as Councilors for a three-year term:

Paul J Luck, Peerless Color Company, Inc

Matthew J Babey, Calco Chemical Division, American Cyanamid Company

Robert C Allison, Geigy Company, Inc

These nominees were unanimously elected.

F C Rippner, Technical Representative, Textile Fibers Department, Carbide & Carbon Chemicals Company, presented a paper entitled "Dyeing and Finishing Piece Goods Made of Dynel/Rayon and Dynel/Rayon/Acetate", which was followed by open discussion.

The attendance was approximately 175.

Respectfully submitted,

NORMAN A JOHNSON,
Secretary

Olney Medal Award of 1954

The Committee of Award would appreciate suggestions regarding candidates for the Olney Medal Award of 1954. These should be in the hands of H C Chapin, AATCC Secretary, not later than March 1, 1954. Data on the accomplishments of candidates should be specific in such matters as journal references or patents, but all definite information will be helpful. Letters from several sponsors of one candidate are needless, except for giving additional data.

Under the rules the basis of award is outstanding achievement in the field of textile chemistry, which is understood to include the development of chemical agents or chemical processes used in the manufacture of textiles or methods of evaluation.

In making awards, the Committee need not be confined to the consideration of any one specific achievement or contribution, but may in its discretion consider the sum total of various and continued contributions to the field, no matter of how long duration.

The citation of the award drawn by the Committee and accompanying the presentation of the medal, shall set forth clearly the occasion for the award.

The voting members of the Committee are Henry A Rutherford, Chairman, Raymond W Jacoby, Harold Y Jennings, Walter M Scott and President J Robert Bonnar, ex officio.

Members of the Student Chapter at Fairleigh Dickinson College following their organization meeting on October 14th. In the center of the photo, behind the banner, which was woven by students in the Textile Department, are the following officers of the Chapter: Nicholas Trocolar, Treasurer; Joseph Nosal, Vice Chairman; Charlotte Dietrich, Secretary; James Polito, Chairman.

FDC Student Chapter Meeting Schedule

THE Fairleigh Dickinson College Student Chapter has scheduled meetings for the second Wednesday of each month, except during vacations. All meetings will be held in the Textile Building from 7 to 8:15 pm.

Current officers and members are as follows:

Officers—J M Polito, Chairman; Joseph Nosal, Vice Chairman; Charlotte Dietrich, Secretary; and Nicholas Trocolar, Treasurer.

Old Members—Vincent Bonavita, Marwin Eichenblatt, Clifford N Gerenz, Richard Glinski, Leo Hogan, Alastair W Hunter, Jay Kelleher, Michael Marriott, Robert Zecker.

New Members—George Brandenburg, Vito D'Allesandro, Frederick Dawson, Marvin Frishman, Wilbur J Gamblin, William Germer, Roy Ghiorai, Fred A Holzapfel, Charles Kahn, Sumner P Lothrop, Martin Samwick, Stanford Schader, Edwin Best.

Honorary Members—Felix Bume, Paul J Luck, P J Wood.

Faculty Members—H R Mauersberger, Advisor; Herman Baumann, Ludwig Fusser, Charles Minoff, Byron West.

Report of November 6 Meeting, WNE Section

SEVERE weather conditions held down the attendance as the Western New England Section met at Rapp's Restaurant, Shelton, Connecticut, on November 6 to hear Elmer H Rossin, technical service manager, Textile Chemicals Dept, Monsanto Chemical Co, speak on "Resin Finishes on Synthetic Fabrics".

In his talk, Mr Rossin discussed the various ways to improve nylon by special finishes that have been developed throughout the industry. Samples were displayed.

Respectfully submitted,
N J GLADE, *Secretary*

Buttons bearing the insignia of the AATCC are now available from the Secretary at a new price of $2.25. Pins, with safety clasp, are also available at $2.50 each. Write directly to H C Chapin, AATCC Secretary, Lowell Textile Institute, Lowell, Mass.

THE APPLICATION OF VAT DYES

Monograph No. 2 of the

American Association of Textile Chemists and Colorists

"The group of fifteen editors responsible for this monograph consists of a well-balanced cross-section of American industry concerned with the production, marketing and application of vat dyes. The AATCC is to be congratulated on the production of a comprehensive survey of American vat dyeing and printing practice which is the major theme of this application . . . the book will be useful as a work of reference at this side of the Atlantic and as a working manual for the American colorists for whom it was designed. . . . If a clear account of American practice is required . . . the enquirer *must* have access to this volume".—*JOURNAL OF THE TEXTILE INSTITUTE* (England).

"This book . . . is abreast of the latest technical developments and research. Its value is increased because of the lack of books in this field today . . . we can readily recommend this book to all technical and practical men".—*MELLIAND TEXTILBERICHTE* (Germany).

The price of "The Application of Vat Dyes" is $5 per copy, postpaid, to members; to nonmembers it is $6 per copy. Send your check or money order to the

SECRETARY AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

P O BOX 28, LOWELL, MASSACHUSETTS

New Program for Subcommittee on Durable Finishes

ERNEST R KASWELL, Fabric Research Laboratories, has succeeded Alden D Nute, American Cyanamid Company, as Chairman of the AATCC Subcommittee on Durable Finishes.

The committee has completed its work in pointing out the importance of making crease-angle-recovery measurements at two different humidity levels, and has recommended tentative test procedures for so doing.

Future work was discussed at a recent committee meeting. It was recognized that the Monsanto and Cyanamid testers previously approved are laboratory instruments capable of making one specific measurement, namely, crease recovery angle after subjecting the specimen to a specific sequence of compressive bending. It was felt that other instruments and methods should be given some attention, particularly those newer techniques that recently have become available, e g, the Schiefer Flexometer, Hebeler and Kolb's apparatus, and the Stoll technique.

More directly, the committee feels that activity in measuring the initial tendency for creases to develop, and concomitantly, the tendency for fabrics to resist desired creasing, should be given attention. Since the man in the street is interested in both the initial resistance of a fabric or finish to wrinkling, and the rapidity with which the wrinkles disappear, as measured by his squeezing the fabric in his hand and watching it spring back when released, the time rate of creasing and recovery is important and should be studied.

Plans for continued activity are now being made. The committee will welcome any suggestions, and help is being solicited from those technical men who are equipped to engage in this activity. Those who are interested should immediately contact Ernest R Kaswell, Fabric Research Laboratories, Inc, 665 Boylston Street, Boston, Mass.

ANNUAL OUTING, PACIFIC SOUTHWEST SECTION
OCTOBER 10, 1953
OJAI VALLEY INN, OJAI, CALIFORNIA

Courtesy of Angus H Roberts, Jacques Wolf & Co

A—Mrs L Szabo; J R Nehmens, Du Pont; L Szabo, California Hand Prints
B—R Butler, Dyecraft; Mrs F Wilhelm
C—A H Roberts, Jacques Wolf & Co
D—J Phillips, Dyemasters; J Smith, Dyemasters
E—W Campbell, Pacific Textile Processing; H Salomon, United Piece Dye Works; L Olson, Ciba Co, Inc; J Phillips, Dyemasters; W Wigglesworth, United Piece Dye Works; J Smith, Dyemasters
F—M Kramer, Hollywood Hand Prints
G—R Andersen, Modern Dyers; F Thatcher, Modern Dyers; F Wilhelm, American Aniline Products, Inc
H—Mrs S Springer; S Springer, Sidney Springer Co; T Smock, General Dyestuff Corp

Fall Meeting Report—— Mid-West Section

THE Fall Meeting of the Mid-West Section at the Bismarck Hotel, Chicago, Illinois, on November 7, 1953, attracted 85 members and guests.

At the afternoon session, L L Walmsley, American Viscose Corporation, spoke on "Fabric Stabilization".

Afternoon business consisted of reports by the treasurer and secretary and the following committee chairmen: Merrill Morris (Intersectional Contest), Walter Jaeger (Corporate Membership), and C Fred Gurnham (Stream Pollution). Announcement was made of the election of Jack Kelley to succeed Kirk P Ferguson as treasurer, Mr Ferguson having transferred from the section.

At the evening dinner meeting, Vice Chairman J G Stott summed up the 1953 National Convention, held in Chicago under the auspices of the Mid-West Section. A motion that one councilor's expenses be paid out of Section funds to attend Council meetings was approved.

E F Smith, Chairman of the Nominating Committee, named the following slate of officers for the coming year:

Chairman———J Gordon Stott

Vice-Chairman———Arthur I Hultberg

Treasurer—Jack G Kelley

Secretary———Harry W Ericson

Councilors———Arthur T Brainerd, Samuel Klein, and Elliott Morrill

Sectional Committee———C M Clevenger, William O Fischer, Peter Ruhl, and Leroy C Voss

Approval was unanimous.

Featured speaker at the evening session was R F Stevens, E I du Pont de Nemours & Co, Inc. His subject was "The Dyeing and Finishing of 'Orlon' Acrylic Fiber".

Respectfully submitted,

VICTOR H LAWRENCE, *Secretary*

Meeting Reports—— NBITT Student Chapter

AT A meeting of the New Bedford Institute of Textiles and Technology Student Chapter on October 27th, with Edmund Dupre as advisor, the following officers were elected:

Chairman———Wallace A Baker

Vice-Chairman———Robert E Griswold

Secretary———Alicia Micus

Treasurer———Eugene P Damm, Jr

Corresponding Secretary———David A Morris

Kenneth H Barnard, American Cyanamid Co, spoke on "Synthetic Fibers and Their Application to Textile Finishes". He later showed a film entitled "It's All in the Finish".

On November 2nd, the Chapter met to select a committee to draw up bylaws and prepare a budget.

Respectfully submitted,

DAVID A MORRIS,

Corresponding Secretary

November 7, 1953 Meeting, Mid-West Section

Front row (l to r): L L Walmsley, American Viscose Corp, afternoon speaker; the late Elmer F Smith, American Aniline Products, Inc, chairman of the Nominating Committee; Joseph H Jones, Phoenix Dye Works, newly elected vice president (Western Region); Arthur T Brainerd, Ciba Co, Inc, retiring vice president (Western Region); R F Stevens, Du Pont, evening speaker.

Back row (l to r): Jack G Kelley, Du Pont, treasurer; Alfred J Olson, Phoenix Hosiery Co, retiring chairman; J Gordon Stott, Ciba Co, Inc, newly elected chairman; Victor H Lawrence, retiring secretary.

November 7, 1953 Meeting, Mid-West Section

(L to r): James L McGowan, Morgan Dye and Bleach Co; John Royce, American Aniline Products, Inc; George B Chabot, Calco Chemical Div, American Cyanamid Co; Aloysius A Gorski, Morgan Dye and Bleach Co; Francis J Connolly, Morgan Dye and Bleach Co; John M Remson, Fero H Ahl, Jr and W W Graham, Du Pont; Kenneth M Harms, Morgan Dye and Bleach Co.

• PATENT DIGEST •

PAUL WENGRAF

COLORING GLASS FIBER FABRICS———Alkaline Pretreatment C, 4, 07

U S Pat 2,645,553
(General Aniline & Film———Lawsberg———July 14, 1953)

The coloring of glass fiber fabrics may be effected either by metallizing the fibers and applying basic or other dyes fixed by this mordant, or by coating with gelatin or a resin composition having some dye affinity. The first method is said to limit the scale of colors while the second renders fibers of poor crock fastness.

Surprisingly, a pretreatment with alkaline solutions of pH 9-13 at 75°C up to the boil for a prolonged period gives the fiber sufficient affinity for dyestuffs of different shades. These shades are made considerably more even and deep by adding a salt or a resin to the alkaline bath. Salts mentioned in the examples include sodium sulfate or sodium chloride (formed *in situ* by partial neutralization). In this case resins have to be thought of in the broadest sense, i e, as any resinous natural or synthetic material (dicyano diamide or melamine resins, lignin sulfonic acid or glue). The claims cover only the use of alkali plus lignin sulfonic acid (the product of sulfite treatment of cellulose).

Example: a woven fabric of glass fibers is immersed for one hour in a solution of pH 11.1 at 75-100°C prepared by mixing 7.2 p NaOH and 2 p crude lignin sulfonic acid. After rinsing the fabric is dyed for one hour at 90-95°C with Benzo Fast Scarlet GS (C I #326), rinsed and dried. A deep and uniform scarlet shade of good fastness to dry cleaning, substantial fastness to washing and fair fastness to crocking results.

Included is a list of acid, basic, direct, acetate and metallized dyes giving good results in this process. Vat dyes or others requiring reduction are excluded.

An exact theory explaining this effect is not presented.

Among the references cited by the Patent Office:

U S Pat 2,407,483 (Owens-Corning Fiberglas/1946): glass fibers may be treated with a substance (e g, alkali) capable of etching the material. This makes the fibers soft and flexible and renders them more resistant to abrasion. No increased dye affinity is reported in this reference.

(It is quite possible that a slight attack of the alkali on the glass substance may produce superficial roughening and increased adhesion of the dye).

WATER-REPELLENT FINISH———Zirconylates plus Waxes or Fats G, 2, 02

U S Pat 2,641,558
(National Lead Co———Urban, Blumenthal ———June 9, 1953)

In contrast to waterproofing procedures, processes for imparting "water repellency" merely render constituent fibers water resistant; penetration under hydrostatic pressure is not prevented. The object of the present patent is to better fix the water-repellent effects on the fibers.

According to the current patent zirconium compounds (see references below), known for imparting water repellency to fibers, paper, etc, are combined with fatty or waxy substances in the form of a complex ammonium salt, wherein the zirconium is present *as an anion.* The zirconium compound in this event adheres firmly to the fiber, at the same time binding any film of fatty character incorporated in the composition. Thereafter the hydrophobic film obtained by this procedure is aftertreated with a (preferably colorless) solution of a heavy-metal salt, e g, zirconium, tin, or aluminum. After being rinsed and dried at elevated temperatures the treated fabrics are said to have a spray rating of 80-100%, and to be able to withstand 4-8 launderings and up to 6 drycleaning operations. Obviously the presence of zirconium in its anionic form is essential in this method.

Example: an aqueous 10% solution of ammonium dicarbonato zirconylate . . . $(NH_4)_2$ Zr O $(CO_3)_2$ . . . is mixed with ammonium oleate and a paraffin wax emulsion is stirred in. A fabric immersed in this liquid, squeezed and aftertreated with a 1.9% solution of basic zirconyl chloride, and then dried at 90°C exhibits durable water repellency. This and other examples substituting for the Zr salt salts of divalent tin or iron may apply to impregnating (photographic) paper as well.

Among the references cited by the Patent Office:

U S Pat 2,457,853 (National Lead Co/1949): producing water-repellent fabrics by impregnating at low temperatures with an ammonium (or alkali) dicarbonato zirconylate plus soap, and drying at 80-100°C.

U S Pat 2,361,380 (Pond Lily Co 1944): impregnating with water-soluble salts of zirconium and volatile acids, drying, and aftertreating with a paraffin emulsion.

Water repellency may also be attained, according to U S Pat 2,482,816 (National Lead Co/1949), by applying dissociated zirconium salts, termed as co-ordination compounds [cf *Am Dyestuff Reptr 38,* 947 (1949)]. This patent differs essentially from the current patent in that the first impregnation does not contain zirconium in the anionic form.

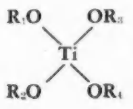
Reference may also be made to French Patent 905,659 (Deutsche Hydrierwerke) [cf *Am Dyestuff Reptr 36,* 134 (1947)], which outlines a water-repellent treatment with solutions of zirconium oxychloride in alkalis to which soap solutions are added.

WATER-REPELLENT WAX SOLUTIONS———Adding Alkyl- and Glycol-Mixed Titanates G, 2, 02

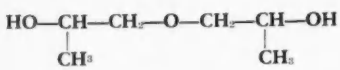
U S Pat 2,628,171
(Du Pont———Green———Feb 10, 1953)

A procedure for rendering fabrics water repellent by using paraffin wax solutions, optionally mixed with water-insoluble metal soaps in volatile solvents, has been known for almost 100 years, as stated in the preamble to this specification (U S Pat 33,902 of 1869 is quoted). Since this time only minor modifications of this standard procedure have been suggested. The greatest drawback of this method is that paraffin wax mixed, for example, with aluminum stearate, is not sufficiently soluble in commercial solvents, such as Stoddard solvent (b p 145-200°C, flash point 100-120°F), which requires heating up to 120°F. Obviously a great fire hazard exists in the preparation of these solutions; moreover the final water repellency is not quite satisfactory as compared with durable effects obtained in the "Zelane" treatment (U S Pat 2,146,392).

The new composition covered by the present patent is said to eliminate these drawbacks. It reportedly provides better solubility in the solvent (thus lower temperatures in application and better water repellency) while eliminating the need for a curing or drying process at temperatures between 105-175°C. It has been discovered that these effects are brought about by adding to the wax-solvent solution between 0.1-25% of a mixed titanium glycol-alkyl ether (percentage calculated from the amount of wax). These esters have the general formula



wherein some of the "R"s represent lower alkyls while others represent glycol—(diol—) groups, such as dipropylene glycol



1-12 octanediol or the like. It is essential that an alkyl group be linked to the OH radicles in 1-3 position because otherwise polymerized, insufficiently soluble products might be formed. Where the alkanediol contains higher chains the ester may show some water repellent properties in itself. These esters promote the solubility of the waxes (primarily those having a melting point of 33-90°C) in the solvent at temperatures as low as 75-80°F (far below the flash point). The customary wax concentration in this type of solution varies between 5-10% and consequently the titanium ortho ester is present in an amount of about 0.01%, soluble in the solvent and also removable in the next drycleaning process.

Example: tetra isopropyl titanate is dissolved in Stoddard solvent and 2-ethyl-1-3-hexane diol is added. Immediately a reaction sets in resulting in the formation of a mixed titanate ester. A solution of melted wax (m p 15°C) in Stoddard solvent is added and the mixture stirred until it becomes homogeneous. A smooth paste is obtained upon cooling that can be thinned at will by the drycleaner.

References cited by the Patent Office:

U S Pat 278,443 (Maxfield/1883): coating paper with Ozokerite solutions to render it waterproof, thereby avoiding the offensive odor of coal tar.

Ind Eng Chem 41, pp 7A and 10A (Oct, 1949) refers to the properties of alkyltitanates, which are soluble in organic solvents and suitable for use in impregnating. The solvent is removed by air drying.

Ind Eng Chem 42, 251-3 (Feb 2, 1950) carries an article by Blumenthal and Smith, which discusses a new preparation method for titanium tetra iodide as well as the properties of this compound.

DYEING MODIFIED POLYACRYLONITRILE FIBERS———Aromatic Carboxylic Acids Added C. 4, 07

U S Pat 2,628,152
(Du Pont———Meunier, Wygand———
Feb 10, 1953)

Although modified polyacrylonitrile material, e g, acrylonitrile copolymerized with vinyl pyridine or vinyl picoline, can be dyed with acid dyes as stated in U S Pat 2,491,471 (reference below), difficulties have been met in dyeing in rope form *staple fiber fabrics* formed from these copolymer filaments. Longitudinal creases and horizontal folds interfere with level dyeing and uneven streaks appear in the finished goods, apparently because of uneven penetration.

This disadvantage is reportedly overcome by adding 5-20 g benzoic or salicylic acid per liter of the dyebath. It has been observed that in this event the dyeing temperature may be lowered from 205-212°F to 180-200°F. Sulfuric acid in an amount of 10% (on weight of fabric) may be added to exhaust the dyebath.

Examples given in this specification refer to various acid dyes, such as Milling Red B Conc (C I #430) or Pontacyl Navy Blue M4B (C I #304) mixed with Anthraquinone Blue SWF Conc (Pr 12). Besides these and other acid types, some dyestuffs generally classified as direct, such as Chrysophenine, Diamine Fast Red F and a series of other products, are enumerated. All are said to give uniform results when used according to the current method.

References cited by the Patent Office:

U S Pat 2,491,471 (Du Pont/1949): acrylonitrile-vinylpyridine polymers containing 2-10% recurrent vinyl pyridine units form films that are readily dyed with acid, chrome and dispersed acetate dyes.

U S Pat 2,527,863 (Du Pont/1950) [cf *Am Dyestuff Reptr 40,* 277 (1951)]: dyeing acrylonitrile-polyvinyl pyridine fibers preferably with acid and acid chrome colors. This patent is copending with U S Pat 2,512,969 [cf *Am Dyestuff Reptr 39,* 766 (1950)].

Brit P 616,385 (Imperial Chemical Industries/1949): dyeing acrylonitrile polymer or copolymer fibers by using dyes of the methin class free from carboxylic or sulfonic groups optionally in the presence of an aromatic acid.

Thomas & Meunier (Du Pont) have discussed dyeing methods of Orlon acrylic fibers and especially the "Thermosol" process in *Am Dyestuff Reptr 38,* P925-7 (1949).

The current specification explains that U S Pat 2,527,863 (see above) refers to blends of the component fibers rather than to copolymers; it is not concerned with streaks occurring in dyeing staple-fiber fabrics.

PIGMENT-PAD DYEING EMULSION———Free of Organic Solvents C. 4, 07

U S Pat 2,627,507
(Sherwin Williams Co———Kuhn———
Feb 3, 1953)

Pigmented lacquer-in-water emulsions have been recommended for dyeing textiles. These emulsions reportedly lack stability, particularly when the emulsions and the textiles are in permanent contact and are continually squeezed between the rolls of the padder. Previous formulations contained volatile organic (water-insoluble) solvents for the resinous binder.

The compositions outlined in the current invention differ in that *no substantial amount of organic solvents* is used. Thus they cannot be defined as true lacquer-in-water emulsions. The external phase is water, while the internal (discontinuous) phase comprises resin, plasticizer and pigment. The composition can therefore be designated best as a *resin-in-water emulsion.*

Volatile solvents (those which boil at less than 225°C) are employed in the order of less than 1% of the composition to insure adequate penetration. The resinous binder comprises a water-insoluble cellulose ether, a water-insoluble alkylated methylolmelamine, e g, butylated or higher alkylated methylolmelamine, and a plasticizer, such as dibutyl phthalate. This concentrate is padded over a three-roll mill until an organic solvent (butyl Cellosolve) is added to facilitate compounding of the resin. This composition is water insoluble and is repeatedly washed to remove remaining Cellosolve and then dispersed in water using oleic acid, triethanolamine and some ammonia.

Either resin pastes, such as Melmac 245-8, which contains some organic solvents, or solvent-free solid forms of butylated-melamine-formaldehyde condensates, such as Resimene 888, can be applied.

It is surprising to find that these aqueous dispersions, useful for dyeing as well as for printing, are stable for 2-3 years. Dyeings are claimed to be of superior fastness, largely due to the fact that the pigment is dispersed in the resinous phase, and is equally dispersed within the resin on the fabric. This is in contrast to former procedures where, in general, aqueous dispersions of the pigment are added to resin solutions.

Reference cited by the Patent Office:

U S Pat 2,527,530 (Interchemical Corp/1950): a pigment-printing method in which a printing paste (clear) mixed of alkali-soluble, water-insoluble and alkali- and water-soluble cellulose ethers is applied, neutralized to gel the alkali soluble component and dispersed in a water-soluble urea- or melamine-formaldehyde condensate.

DYEING DACRON WITH VAT ACIDS———Heat Aftertreatment C. 4, 07

U S Pat 2,627,449
(Luttringhaus, Mautner and Arcus———
Feb 3, 1953)

The preamble to this patent discusses dyeing methods for ethylene glycol terephthalate, i e, Dacron or Terylene. It has been suggested that these fibers be dyed with pigments and then aftertreated in molten-metal baths. This procedure improves the results of prior methods but the depth of shade is said to remain limited for most dyestuff groups and alkaline vats fail to be absorbed satisfactorily.

It has been discovered that Dacron can be dyed with vats in light medium and dark shades by padding in the form of *vat acids,* subjecting the material to a heat aftertreatment (300-400°F), and re-oxidizing as usual. The heat treatment can be carried out by irradiation with infrared dyes in a curing range (examples 1, 3 and 6) or by passing through a Wood's molten-metal bath (examples 2, 4, and 5). The acid vat is prepared by slowly adding acid (preferably acetic) to the alkaline vat solution in the presence of a dispersing agent that is effective in acids such as alkylbenzene sulfonates or sulfonate-formaldehyde-naphthalene condensates to adjust the liquid to pH 2-5. The padded and heat-aftertreated goods are re-oxidized by a passage through persulfate or the like, or simply by atmospheric oxygen, after scouring.

Example: Indanthrene Brilliant Pink R (C I #1210) is vatted with caustic soda and hydrosulfite in the presence of a sulfonated-formaldehyde-naphthalene condensate, then cautiously neutralized with acetic acid. Dacron slubbing is padded with this solution at 180°F to a pick-up of 100% and passed through a bath of Wood's metal (350°F) for 2 minutes leaving this bath practically dry. Re-oxidation is effected with a 1% potassium persulfate solution. A brilliant dark red shade of excellent fastness to light is said to result.

Among other references cited by the Patent Office:

U S Pat 1,900,172 (Celanese/1933): dyeing acetate of cellulose with vat acid obtained by carefully neutralizing the alkaline vats with acetic acid, and optionally adding a protective colloid, such as gelatin.

U S Pat 2,107,526 (H Dreyfus/1938): vat dyeing cellulose acetate fibers by padding with a vat preparation, drying in substantial absence of oxygen (carbon dioxide atmosphere) and re-oxidizing as usual.

Brit P 620,584 (Morton Sundour Fabrics/1949): outlines method and apparatus for treating cloth in a molten-metal bath at temperatures between 80-100°C to develop various classes of colors. [This patent has been discussed in digest of Brit P 663,066, cf *Am Dyestuff Reptr 41,* 306 (1952)].

Reference may also be made to Sandoz' U S Pat 2,590,213 [cf *Am Dyestuff Reptr 41,* 506 (1952)], which suggests dyeing with concentrated dispersions of vat acids, and to Celanese's U S Pat 2,598,786 [cf *Am Dyestuff Reptr 42,* 19 (1953)], which refers to dyeing cellulose acetate by padding with acid vats, re-oxidizing and reducing again. Both patents were granted after the date of application of the current patent.

DYEING DACRON FIBERS ———Preheating C, 4, 07

Brit P 684,046
(Imperial Chemical Industries———Hardwick, Wood———Dec 10, 1952)

Dacron (polyethylene-terephthalate) fibers quite generally have poor dye affinity. Any method that will increase the dyeability of these fibers is evidently very desirable.

The inventors have attacked this problem by subjecting the material to be dyed to a preheating treatment of 230-265°C, which may be effected in any possible way, e g, by applying hot inert liquids or molten-metal baths, hot inert gases, infrared lamps, etc. Putting them in contact with a hot-metal surface is the simplest way to preheat the fibers. In this operation the goods may or may not be relaxed; in the case of yarns, however, they should be predrawn to a highly oriented state and then relaxed in the subsequent heat treatment.

Example: a plain-weave fabric composed of 70 denier terephthalate yarn is passed for about 10 seconds over a metal surface heated to 240°C and dyed thereafter in a bath containing 6% Solacet Fast Green (on weight of fabric) and 30% common salt for 90 minutes at the boil. A medium green shade results. A nonpreheated sample, dyed under the same conditions, shades only a pale green.

Reference is made to the Dacron-dyeing process described in Brit P 659,667 of Stevenson's Dyers Ltd [cf *Am Dyestuff Reptr 41,* 118 (1952)] advocating a heating *aftertreatment* under pressure, analogous to the "Thermosol" process.

PRINTED CALENDER EFFECTS———Resists under Resin Finishes G, 4

Brit P 684,849
(Calico Printers Assoc———Miller———Dec 24, 1952)

Permanent calendering, embossing and glazing effects may be produced by applying an initial condensate of aldehydes with other aldehydes, or with alcohols or ketones, in the presence of an alkaline catalyst. It is also possible, as stated in the preamble, to print an acid resist on fabrics impregnated with a solution of this type and thereupon to subject the goods to an appropriate "ornamentary" treatment, which is followed by heating to complete insolubilization.

Drying of the impregnated goods must precede the ornamenting step. It is essential that drying conditions be carefully controlled to prevent premature curing. This is especially critical when one wishes to have only selected areas show the calendering effect. [The resin on the plain non-embossed) portions has to be removed later by rinsing]. It might also be possible to impregnate with a resin precondensate containing the catalyst and to print a neutralizing resist after drying, but this procedure would involve two controlled drying operations with the inherent risk of partial insolubilization of nonprinted areas.

This disadvantage may be avoided, according to the present specification, by *preprinting* as a resist a salt *that becomes almost insoluble* upon heating but still remains capable of neutralizing the alkaline catalyst. The printed fabrics are thoroughly dried by heat to insolubilize the resist and are then impregnated with aldehyde-aldehyde- or aldehyde-ketone precondensates plus alkaline catalyst. After the moderate-temperature drying, ornamenting (embossing, glazing or frictioning) and subsequent curing operations, the portions containing the resist salt become soft after being rinsed, while the nonprinted areas retain the embossed effect.

Salts for neutralizing the alkaline catalyst used in this method may consist of weakly basic metals (Al, Cr, Mn, Sn, etc) and organic acids, such as formic or acetic, or ammonium salts of sparingly soluble organic carboxylic acids, e g, hydroxynaphthoic acid. Alkali-condensed aldehyde reaction products generally have been characterized here, the precondensate of formaldehyde and acetone being preferred.

Colored effects may be produced either by using the metal contained in the resist as a mordant, e g, aluminum, or by adding a dyestuff to the portion not covered by the resist. In the first instance a colorless plain effect and ornamented colored portions result, while in the second, the plain areas are colorless and the ornamented parts colored.

One of the examples dealing with ornamentation by friction calendering includes the following steps: preprint with thickened aluminum formate, dry, impregnate with a precondensate of formaldehyde-acetone catalyzed with soda ash, dry below 100°C to a moisture retention of 8-10%, pass through a frictioning calender, cure at 120°C, wash and dry. A plain pattern on glazed ground is obtained.

Another example, referring to embossing: preprint the ammonium salt of 2—OH—3—naphthoic acid, dry thoroughly, impregnate with a solution of the aforementioned precondensate (drying below 100°C under identical moisture conditions), pass finally through an embossing calender and cure at the same time. The final result in this case is a plain pattern on an embossed ground. Many interesting colored combinations using fixation by the cured resins are possible.

Prior art describing calender effects with resin solutions might be compared with the present development. British patents 452,435 (1936) and 445,261 (1936), of the same assignee as above, and Brit P 445,774 (Raduner) should be mentioned here.

ABSTRACT

Bleaching Dacron Polyester Fiber

Anon, *Textile Age* 17, 22-23, June, 1953.

It is usually considered unnecessary to bleach Dacron polyester fiber, since it is naturally quite white, particularly the delustered (pigmented) type.

Where mixtures of Dacron and other fibers must be bleached, any bleaching procedure which is suitable for the other fiber should be satisfactory. Dacron has excellent resistance to oxidizing agents and is not degraded appreciably by the bleaching treatments normally used on other fibers.

Where fabrics made from Dacron are stained or discolored during processing, it may be advisable to bleach them. Stains and discolorations can often be removed from combination fabrics containing Dacron with sodium chlorite, peracetic acid, sodium hypochlorite, hydrogen peroxide, sodium perborate, or other bleaching agents. The type and concentration of all ingredients in the bleach bath, and the time and temperature of the treatment will largely depend on the other fibers present in the fabric.

Bleaching treatments, however, are not always effective in removing certain types of stains, particularly oils and greases. In some cases bleaching may "set" stains in the fabric so that they become difficult or impossible to remove by other methods. For this reason a stained or discolored fabric should be scoured before bleaching. In some instances it may also be advisable to spot or dryclean the fabric prior to scouring and bleaching.

Of the various bleaching agents which have been tested on fabrics made entirely from Dacron, sodium chlorite (Textone) in an acid bath seems to be the most effective for removing most types of stains and discolorations. The author recommends bleaching at the boil for about 1 hour in a bath containing 1.5 lbs of Textone and 1.5 lbs of 61 per cent nitric acid per 100 gals of solution, followed by rinsing and scouring in an alkaline detergent bath.

He cautions that this formula should be used in No. 316 stainless steel, to avoid corrosion of equipment, and employed only when adequate ventilation is available.—WHC.

NEWS

• New German Standard Color Chart

The Committee of Color Standardizing, a member of the German Standardization Committee, in collaboration with the Color Research Laboratory of the Board of Testing Materials, Berlin-Dahlem, Germany, has laid the experimental and technical foundation for a new standard color chart. The result of several years of preparation, the new system utilizes the psychological equidistancy and equivalency of the color selected.

Research on the new color chart was conducted under the direction of Manfred Richter, editor of *Die Farbe*, published by Verlag für angewandte Wissenschaften, Wiesbaden, Germany. The chart is discussed in detail in *Die Farbe 1*, No. 3/6; 1952/53.

• Examination for Textile Technologists

The Civil Service has announced an examination for textile technologists for the new Quartermaster Research and Development Command now being constructed at Natick, Mass. The announcement outlines the experience required of applicants for employment in a range of positions from $4,205 to $9,600 per year.

Forms to file under this examination may be obtained from the Board of United States Civil Service Examiners, Quartermaster, Research and Development Command, Natick, Mass.

• Original Textile Prints in New Ad Series

The Alliance Color & Chemical Co, 33 Avenue P, Newark 5, N J, is presenting a series of original textile prints in their advertising pages, the first of which appeared on page 37A of the December 7th issue. These designs were created by the Goodenow brothers.

Earle Goodenow was formerly art director for Kenyon & Eckhardt, Inc, and is now painting in Italy in preparation for another exhibition of his oils and water colors. Girard Goodenow is noted for his art work and paintings, which have appeared in many advertisements of national advertisers signed with his trade name, Gig. He is probably best remembered for his animal illustrations for the Ethyl Corporation.

By the use of special inks and extreme care the colors used in these advertisements are exact matches for fabrics which have been dyed or printed with Alliance's fast color bases, salts and stabilized azoics. Alliance points out that they can be used, therefore, by the dyer or printer as an accurate indication or suggestion of the effects which he can obtain.

Permission for the reproduction of these prints, as well as the use of the original art work may be obtained by writing to the Alliance Color & Chemical Co.

• Dates Set for Expanded 1954 Southern Textile Exposition

The 18th biennial Southern Textile Exposition will be held October 4-8, 1954 in Textile Hall, Greenville, S C, according to an announcement by Bertha M Green, director.

At the same time it was made known that additional space will be provided for 1954, permitting the inclusion of some exhibitors who could not be accommodated in the 1952 show, the largest in the nearly 50 years it has been held.

Last year 259 exhibitors shared a total exhibit area of nearly 50,000 square feet. The 1952 exposition drew an estimated 40,000 people in the trade from all parts of the United States and some foreign countries.

Textile Hall, built in 1917 especially for the exposition and the showing of heavy machinery, has been substantially enlarged by annexes. For the 1952 show a permanent brick and steel annex was built and Textile Hall underwent a $100,000 face-lifting and renovation.

In the past years the exposition has run five and a half days, opening on Monday morning and closing Saturday afternoon. However, in response to numerous requests for a five-day show and shorter hours, the 1954 show will open Monday morning and close Friday afternoon. The hours will be 9 AM to 6 PM each day.

• Henneux Handling German Sizing and Desizing Materials

The Henneux Company, 45 Columbus Ave, New York 23, N Y, has introduced to this country sizing and desizing materials manufactured by Kalle & Co (formerly I G Farben), West Germany.

The products include:

Tylose—a water-cellulose derivative for sizing

Viveral R P Conc—a colorless enzyme for starch desizing

Biolase P (soft or permuted water)—for desizing raw and fast dyed textiles of all types

*Biolase C*12 Powder (hard water)—for desizing raw materials and dyed goods of all types

One-bath-process Biolase:

Process I—for dyeing and desizing in one bath of cotton fabrics and mixed fabrics of cotton and synthetics;

Process II—for desizing, scouring and dyeing in one bath of spun rayon and mixed fabrics of cotton and spun rayon

Process III—for dyeing, using the Foulard of the jigger, without previous desizing and scouring.

• SCI Group to Hold Symposium on Synthetic Fibers

The Plastics and Polymer Group of the Society of Chemical Industry has decided to hold as part of its program for the 1953-1954 season a symposium to be called "The Chemistry and Physics of Synthetic Fibers". Papers will be presented and discussed on the chemical and physical basis of fiber formation and the properties of fibers in relation to the molecular structure and conditions of formation. The phrase "synthetic fibers" is to be interpreted in the broader sense, meaning material brought into a fibrous structure by a manufacturing process, irrespective of the source of the raw materials. In order to limit the scope of the symposium, the process of dyeing, the properties of textiles, the economics of the industry and historical surveys will not be included as major items, although reference may be made to such topics if they have an important bearing on the basic theme of the symposium.

The symposium will be held March 24-26 in the lecture theatre of the Institution of Electrical Engineers, Savoy Place, London, England.

Further details will be issued later, together with procedure for registration for the symposium.

Authors who wish to contribute papers should get in touch with A R Burgess, Plastics and Polymer Group, Society of Chemical Industry, 56 Victoria Street, London, S W 1, England.

Jack J Press, fiber specialist to the United States Navy Clothing Supply Office, operates his latest invention—a pilling tester.

• Navy Develops New Pilling Tester

The United States Navy Clothing Supply Office, Naval Supply Activities, Brooklyn, New York, has completed preliminary tests on a new method for determining the resistance to "pilling" of woolen and worsted type fabrics containing synthetic fibers, such as nylon and Dacron.

As part of a program aimed at both improving the comfort and durability of woolen and worsted uniform fabrics and at the conservation of wool, the development of this test was undertaken. The Navy's new machine works only on the surface of the fabric with a selected abradant and a combined rolling and twisting action. It is designed to indicate the tendency of the fabrics to pill, how long the pills will last, and how objectionable they will be. It is claimed that, with this new machine, direct correlation has been established between laboratory tests and pilling in wear for tropical, serge, flannel, and melton fabrics, suggesting the possible establishment of suitable control and acceptance standards for pilling.

• 3-D Technique Available to Lab Planners

Those planning new laboratories or additions to existing facilities will be interested in the 3-D Lab Planning Kit now being offered free by Labline, Inc, 217 N Desplaines, Chicago 6, Ill.

The kit consists of 26 scaled 3-dimensional models which correspond to full size sectional metal furniture. Also included are ruled layout sheets scaled ½-inch to the foot. Models are imprinted in detail, and once assembled and placed on the layout sheets, arranging and re-arranging of various combinations or layouts can be worked out.

A 28-page catalog accompanies the kit.

• New Approach to Textile Structure Designing

A new approach toward adapting common available fabrics to industrial uses appears to be gaining wide acceptance in the textile industry.

The new approach, taught for the past seven years in the Textile Engineering Department of Lowell Techonological Institute, places the design of a textile structure on a more scientific engineering basis similar to the method by which an engineer would design a bridge structure. It correlates engineering principles, properties of textile materials, and textile processing in the design of a textile structure with desired properties. Industrial and many other types of fabrics can be specifically designed for the particular end-use requirements with more than a reasonable assurance of their success, it is claimed.

Professor Herbert J Ball, Head of the Textile Engineering Department at LTI and holder of the Harold DeWitt Smith Memorial Medal for 1953 from Committee D-13 of the American Society for Testing Materials, spearheaded the initiation of this course at the Institute in 1947. Entitled "Engineering Design of Textile Structures," it deals with the geometry of yarns and fabrics and the extent to which it is possible to design the dimensions of a textile structure for a particular functional use or to predict the dimensional change which will occur during such use. Another division of the course deals with the design from the standpoint of stresses, strains, and energy changes which the end-use imposes.

The theory of this work is based in part on the work of Fredrick T Perice.

• Biuret

Biuret ($H_2NCONHCONH_2$), a new experimental product of the Nitrogen Division, Allied Chemical & Dye Corp, 40 Rector St, New York 6, N Y, is now available in test quantities. It is similar to urea and reportedly can be used in applications where urea or melamine are now used. It is pointed out that it is not intended to replace these products, but rather to supplement them in uses where its properties prove valuable.

Among its suggested applications are the following: resins for textile treating, dyes, and specialty products.

Product Bulletin PD-B-1, available from the Nitrogen Division, lists the product's physical and chemical properties, reactions, handling and storage requirements and availability. The bulletin also lists a number of patents describing resinous products obtained by reacting biuret with various agents.

NAMES IN THE NEWS

H R Walker

JAMES C WALKER, vice-president in charge of the Dyestuff Department of Sandoz Chemical Works, Inc, has announced the appointment of HOWARD R WALKER, JR, as assistant technical director of the Dyestuff Division. His duties will be to co-ordinate the technical work of the entire division.

Howard Walker has had previous experience as plant chemist in the Southeastern district, namely, with United Merchants & Manufacturers, Deering Milliken and Riegel Textile Corporation.

WALTER K FRICKE and WILLIAM C KASTNER, supervisors at General Aniline Works, Linden, N J, observed thirtieth anniversaries with the company recently. The two "oldtimers" were guests of honor at a luncheon attended by plant executives in the plant cafeteria.

Born in Helmstedt, Germany, Mr Fricke came to this country to work in the New York laboratories of Kuttroff and Pickhardt, dyestuff dealers. When the firm was absorbed by General Dyestuff, Inc, he was promoted to dyer and demonstrator. In 1928 he transferred to General Aniline's Grasselli Dye Laboratory. He was appointed chief colorist and laboratory supervisor more than 15 years ago.

A native of Newark, Mr Kastner was raised in Linden. Employed by General Aniline in Linden in October, 1923, Mr Kastner has been associated with company transportation and warehousing operations, coming up through the position of chief clerk of the Administrative Office to various key supervisory positions in the Accounting and later in the Transportation and Warehouse departments.

HOOKER Electrochemical Company has added three men to its research and development staff.

BLAINE O SCHOEPPLE has been assigned to the plastics and resins group; LEOPOLD A ROBILLARD, to the pilot plant development group; and SAMUEI GELFAND, to the fluorine chemicals group.

THE following slate of officers was elected by the Association of Consulting Chemists and Chemical Engineers, Inc, at its annual meeting on October 27th:

President—FOSTER D SNELL, Foster D Snell, Inc

Vice president—ABRAHAM TAUB, N Y College of Pharmacy

Secretary—THOMAS P KEARNEY, Industrial Testing Labs

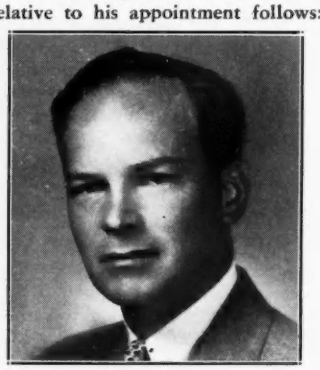
Treasurer—PERCY E LANDOLT, Landolt & Whitney

New Councilors—CARL BUSSOW, A W Dow, Inc; CHARLES DAVIDOFF; HARRY W DIPPEL, Stillwell & Gladding, Inc; HENRY L SHULDENER, Water Service Labs, Inc; ROBERT STECKLER, R Steckler Labs; G H MORSE, Morse Labs (filling unexpired term of HUGO KLEIN); and SIDNEY LEE, The Dallas Labs (filling unexpired term of ROBERT V SIEBEL).

Hold-over Councilors—ERWIN DiCYAN, DiCyan & Brown; ROBERT S ARIES, R S Aries & Associates; HAROLD BECHER; WILLIAM C BOWDEN, JR, Ledoux & Co, Inc; REGINALD S DEAN, R S Dean Labs Inc; ELLIOT A HALLER, Haller Testing Labs Inc; CLARENCE E MANGE, C E Mange Development Lab; ALVIN C PURDY, Bull & Roberts, Inc; and EARL D STEWART, Schwarz Labs Inc.

• Correction

We regret that the photo captioned "G A Sharpe", which appeared on page 743 of our October 26th issue, was not of Mr Sharpe. The correct photo and a reprint of the news item relative to his appointment follows:



G A Sharpe

GRANT A SHARPE has been appointed sales representative of General Dyestuff Corporation in upper New York State. He will reside in Syracuse. Mr Sharpe, who succeeds GEORGE B MARTIN, joined GDC in 1937. Prior to assuming his new duties, he was sales representative in the New York-Paterson area.

L E Cuckler

LEE E CUCKLER has been named manager of the Engineering Department of Fielden Instrument Division, Robertshaw-Fulton Controls Company, Philadelphia, Pa, responsible for all application engineering and technical services. Prior to joining Fielden, Mr Cuckler was head of the Textile and Paper Group of the Application Engineering Department at Brown Instrument Division, Minneapolis-Honeywell Regulator Company, from 1943 to 1952.

IN two recent promotions by the Du Pont Company, WILLIAM F McGOWAN was made director of the Manufacturing Division for acetate, "Dacron" polyester fiber, and "Orlon" acrylic fiber, and EDGAR H BLECKWELL was named to succeed Mr McGowan as production manager of nylon manufacturing, both in the Textile Fibers Department. Mr McGowan succeeded WILLIAM T WOOD, who has been put in charge of direct sales in the department.

THE following scholarship winners have been announced by the School of Textiles, North Carolina State College:

American Enka Corporation, DONEL T KELLEY.

American Viscose Corporation, CLAUDE E LAYMAN.

Carbide and Carbon Chemicals Company, CHARLES B TUCKER.

Celanese Corporation of America, G M RANDOLPH.

Monsanto Chemical Company, G K BLANTON.

RE HORSEY, vice president in charge of sales of Givaudan-Delawanna, Inc and its associate companies, Givaudan Flavors Inc and Sindar Corporation, has announced that JAMES L STEVENSON has joined his father RALPH M STEVENSON in the representation of the Givaudan organization in the Detroit area. Mr Stevenson was formerly associated with the Chrysler Export Corporation where he handled sales relations with the Caribbean area and Central and South America.

INSTITUTE OF TEXTILE TECHNOLOGY
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6 APR 1953

OFFICIAL PUBLICATION OF THE PROCEEDINGS AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

VOLUME 42, NO. 7
MARCH 30, 1953

AMERICAN DYESTUFF REPORTER

Devoted to Textile Chemistry
BLEACHING · DYEING · PRINTING · FINISHING

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IRGALANS*
revolutionize wool piece dyeing

Mill performance daily is emphasizing how revolutionary are the Irgalan colors.

Shorter dyeing time in neutral to slightly acid baths produces level dyeings and penetration undreamed of for colors possessed of such fastness to light and wet finishing.

The result — mills are definitely improving the quality of their fabrics, through retention of fibre strength and preserved abrasion resistance.

Yes — mills are obtaining spectacular results on flannels, fleeces, bouclés and even tightly woven gabardines•when dyed in the piece.

Dyers are happier using the Irgalan colors because they strike alike so that the dyers are constantly in control of the shade. Moreover, the Irgalans are "congruous"—one property chart agrees with unusual precision with the others —excellent for control of fastness.

Let the Geigy representative show you examples of Revolutionary Dyeing with Irgalans.

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Now—you can pick the PRYM best for your specific needs

PRYM A
is applied to viscose and acetate rayons, and blends of Nylon, Orlon and Dacron fibers to provide extremely durable stabilization and crease resistance. Ideal for durable embossing and schreinering of 100% acetate fabrics. Prym A is **chlorine resistant** on viscose rayons.

PRYM S
gives much softer hand than Prym A — is used on viscose and acetate rayons, and blends of Nylon, Orlon and Dacron fibers. Extremely durable stabilization, and crush resistance.

PRYM DS
is applied to cotton, rayon and blends for a) durable stabilization, b) crush resistance, c) mechanical finishes. Gives a firmer hand than Prym S in durable mechanical finishes.

PRYM® RESINS

PRYM CR
gives stabilization and crush resistance to cottons. **No chlorine retention** — no yellowing of whites!

PRYM N
is applied to Nylon, acetate, cotton and viscose rayons. Durable Nylon stiffening (shoe cloth, ribbons, taffeta, etc.). Permits exceptionally durable mechanical finishes on cotton and rayon.

STABLE to STORAGE
without refrigeration regardless of temperature changes!

the new series of resins that give mechanical finishes, superior crush resistance, shrinkage control, plus greater durability than ever—at lower costs!

Prym finishes are liquid, completely soluble in water. Easy to apply with standard procedures. Most economical, most efficient of the thermosetting resins. For technical data, samples or consultation, write, wire or phone

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Atco CSN	8-F
Atconil PW-35	1-K
Atcowet B	12-M
Atcosyn	10-H
Atco DA	102-A
SOAPS	
Atco Soap 55	7-E
Atco Soap M	7-D
Atco Fig Soap	7-B
Atco Cold Scour	11-C
Atco Solvent 50B	11-A
WETTING AGENTS	
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Atcopen 2T	12-E
DYEING ASSISTANTS	
Atconil 0-20	9-G
Atconil DAC-25	21-A
SULFONATED OILS AND SOFTENERS	
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Atcotal	23-B
Sulf. Castor Oil	23-C
Sulf. Red Oil	23-D
Sulf. Soya Bean Oil	23-E
Sulf. Peanut Oil	23-F
Atco Finishing Oil DR	132-A
SYNTHETIC SOFTENERS	
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Atcosoft RA-25	5-L
Atcosoft N	5-H
Atco Resin Softener UF	1-O
ENZYMES	
Atcozyme Powder	17-A
Atcozyme H Sol.	17-D
Atcozyme H Pwd.	17-C
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Atco Anti-Static N-30	5-K
Atco Anti-Static X-30	5-M
Atco Anti-Static D-30	5-N
GRAPHITE REMOVERS	
Atco Graphite Remover LV	22-A
Atco Graphite Remover HV	22-A
MERCERIZING ASSISTANTS	
Atco Merpene Special	1-L
CARBONIZING ASSISTANTS	
Atco Carbowet B	12-L
Atco Carbowet BNF	12-L-1

PRODUCT CLASSIFICATION	BULLETIN NUMBER
WEIGHTERS	
Atco Weighter #1	13-W
Atco Weighter #2	13-D
Atco Weighter #250	13-P
DULLERS	
Atco Light Duller	14-E
Atco Dark Duller	14-D
RESINS	
Atco Paste Resin 400	4-B
Atco Liquid Resin 150	4-C
Atco NS	15-B
Atco Ribbon Finish GCN	132
PRINTING BINDERS	
Metaperm GS	4-G
Metaperm KG	15-G
SLIP-PROOFING AGENTS	
Atco Bindtex R	13-E
Atco Slip-proof N	13-U
ANTI-FUMES	
Atco GS	6-C
Atco FP	6-J
STIFFENERS	
Atcoperm	4-D
Atco Finish 80B	13-X
Atco Finish 81	132-B
WATER REPELLENTS	
Atcodri TSM	2-D
Atcodri 33	2-F
Atco Water Repellent WM	2-G
Atcodri A & B	2-B
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ANTI-FOAM	
Atco Hydrofoam	1-J
STRIPPING AGENTS	
Atco Liquid Strip	1-M
GUMS	
Atco Gum Trag	24-A
Atco Locust Bean Gum	24-B
Atco Vat Gum	24-C
Atco Gum Arabic Solution 50%	24-D
LACQUERS	
Atco Printing Lacquer #667	1-Q
Atco Lacquer Thinner #667	1-R
WATER SOFTENERS	
Atco Water Softener	16-D
SEQUESTRIENTS	
Atco CCF	16-L
MISCELLANEOUS	
Atco Soluble Wax	1-P
Atcofix D	13-C
Atco Flameproof	1-C
Atcosolve TR	8-C

Get complete technical information on any product listed . . . simply list product or bulletin number.
The above product listing does *not* cover the full ATCO line. Space would not permit listing all ATCO products.

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The Price is Higher and well worth *each extra* Penny!

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AEROTEX SOFTENER H has been developed specifically to give your fabrics finer quality, provide a full yet soft hand, and to reduce your application and storage problems.

Look at the long list of advantages. One of our technical representatives will be glad to show you how AEROTEX SOFTENER H can serve your needs.

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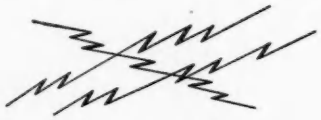
Provides smooth, supple, full and soft hand to cotton, rayon, acetate, wool, nylon, acrylic and polyester fibers.

Fully compatible with the most widely used synthetic resin solutions.

Easily dispersed in warm water—does not require boiling. Stable to both acids and alkalis. Finish always uniform, with no specking.

Easy to handle—a creamy paste. Excellent stability and wetting properties.

Does not develop rancid odors in storage.



Reduces static electricity during weaving and finishing. Cloth plaits smoothly in boxes. Cleaner and more uniform carding.

Reduces static electricity in finished fabrics. More efficient cutting and sewing. Garments don't attract lint and dust, don't cling.

Does not yellow in storage or when exposed to heat. Does not discolor after washings or cleanings.

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AMERICAN
DYESTUFF REPORTER

Volume 42

January, 1953-December, 1953

Including the

Index to

PROCEEDINGS OF THE

AMERICAN ASSOCIATION OF

TEXTILE CHEMISTS AND COLORISTS

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